

PLANMED SOPHIE

MAMMOGRAPHIC X-RAY UNIT



USER'S MANUAL

En

788000/20

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PLANMED pursues a policy of continual product development. Although every effort is made to produce up-to-date product documentation this publication should not be regarded as an infallible guide to current specifications. We reserve the right to make changes without prior notice.

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This manual is valid from software versions:
-rear processor 1.80
-generator processor 1.80

1 INTRODUCTION

This guide describes how to set up and use the PLANMED Sophie mammography x-ray unit. This unit must only be used for mammography.

NOTE *The use of Sophie mammographic unit is allowed only under supervision of a health care professional*



Sophie mammographic X-ray fulfills the requirements of Directive 93/42/EEC.

NOTE *This manual is valid for software revisions 1.77 or later.*



All key illustrations indicate that the key should be pressed, or where indicated, pressed and held down. Pressing a key will switch a function on or off depending on the original setting. When a function is on, or activated, the key indicator light will either come on or start to flash.

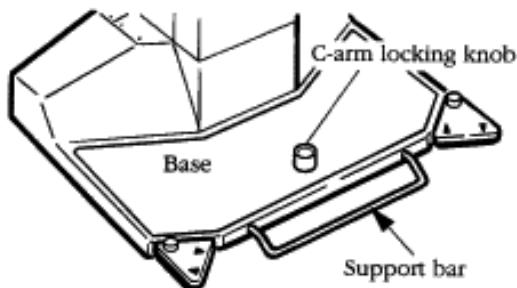


The display values in this guide are only examples and should not be interpreted as recommended values unless otherwise stated.



WARNING
IF THE UNIT IS NOT BOLTED TO THE FLOOR THE SUPPORT BAR MUST BE ATTACHED TO THE FRONT OF THE BASE.

NOTE *Make sure that the C-arm locking knob has been removed from the unit's base. If not, remove it by turning it counterclockwise.*



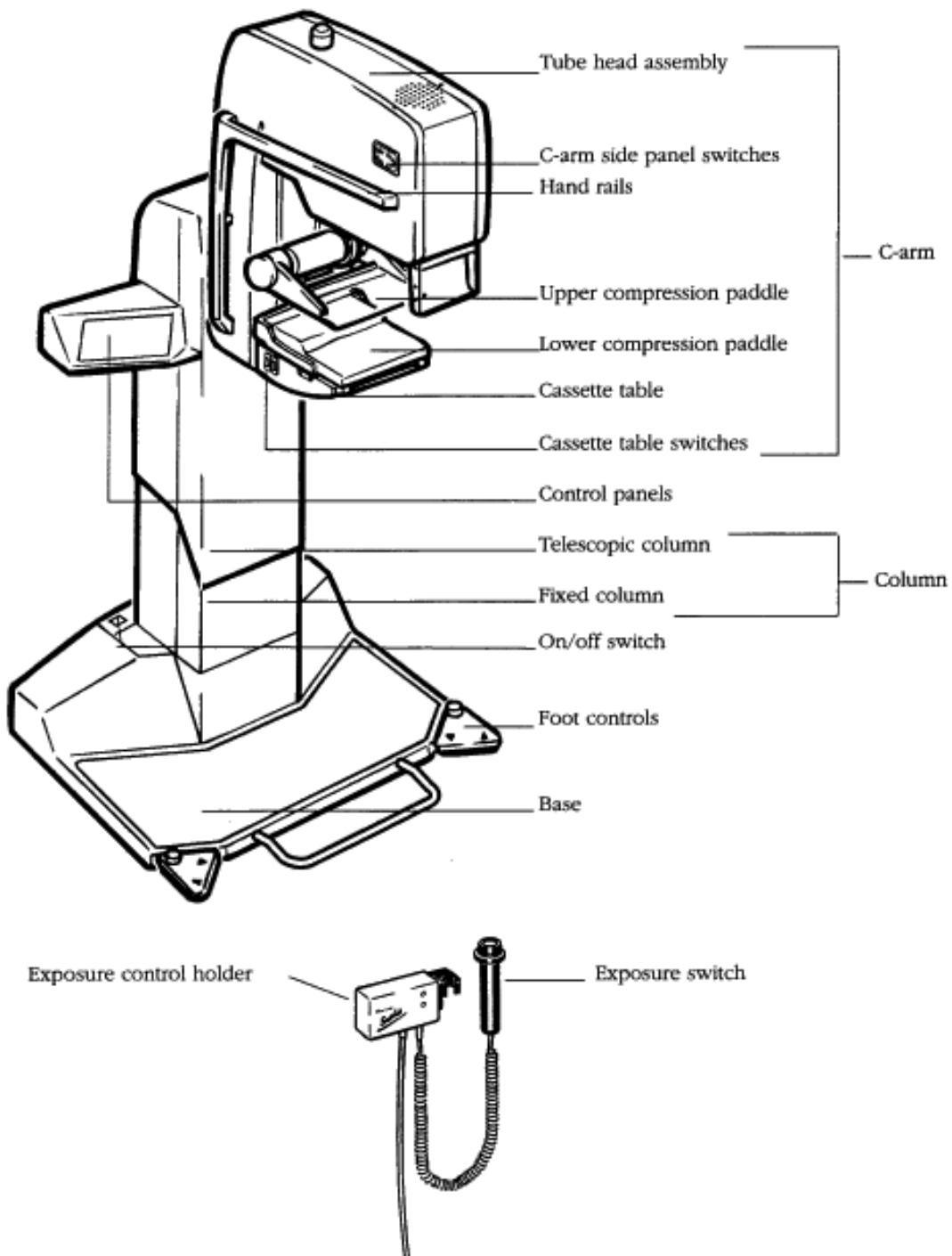
The manufacturer, assembler, and importer are responsible for the safety, reliability and performance of the unit only if:

- installation, calibration, modifications and repairs are carried out by qualified authorized personnel
- electrical installations are carried out according to the appropriate requirements such as IEC364
- equipment is used according to the operating instructions

2 CHECK LIST BEFORE OPERATION**ATTENTION**

IT IS VERY IMPORTANT THAT THE PLACE WHERE THE UNIT IS TO BE USED AND THE POSITION FROM WHICH THE USER IS TO OPERATE THE UNIT ARE CORRECTLY SHIELDED. SINCE RADIATION SAFETY REQUIREMENTS VARY FROM COUNTRY TO COUNTRY AND STATE TO STATE IT IS THE RESPONSIBILITY OF THE USER TO ENSURE THAT ALL LOCAL SAFETY REQUIREMENTS ARE MET.

- Make sure that you are fully acquainted with the appropriate radiation protection measures and these operating instructions before using the unit.
- The unit is designed to operate using a line voltage of between 187 and 265 V~ (50/60Hz) and a line current of 15A. If the unit is being used in a new location for the first time check that the power supply you intend to use is suitable for the unit.
- Make sure that the exposure switch is installed behind a radiation protection shield.
- Always use fresh film. Store and handle the film according to the manufacturer's instructions.
- Make sure that the film and screen are compatible.
- Make sure that the intensifying screen is clean and free from dust. Clean the screen at the beginning of each working session.
- Make sure that the film processor is correctly set up for processing mammography films.
- Film viewing facilities should be available on site so that the radiographs can be examined. Make sure that the illumination level of the viewing equipment being used meets the film manufacturer's recommendations.

3 THE MAMMOGRAPHY UNIT**3.1 MAIN PARTS**

THE MAMMOGRAPHY UNIT

3.2 UPPER COMPRESSION PADDLES



High lip paddle 18 x 24cm



Biopsy paddle - single hole



Spot paddle



Twincomp paddle 18 x 24cm



Biopsy paddle - multi hole



Large paddle 24 x 30cm

3.3 LOWER COMPRESSION PADDLES AND BUCKY GRIDS



Paddle 18 x 24cm



Bucky grid 18 x 24cm

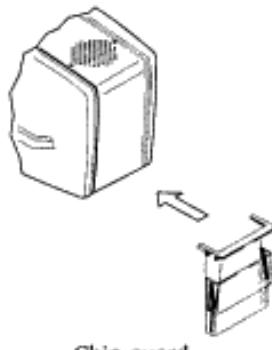


Large paddle 24 x 30cm

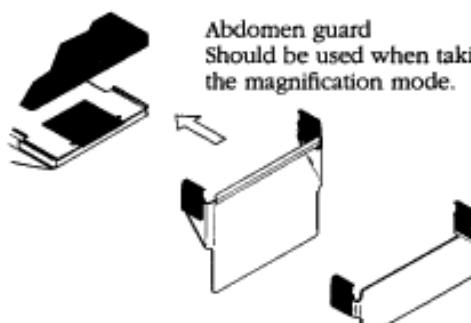


Large Bucky grid 24 x 30cm

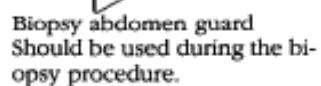
3.4 GUARDS



Chin guard



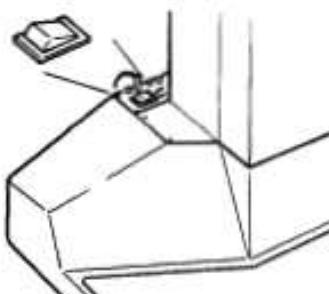
Abdomen guard
Should be used when taking exposures in the magnification mode.



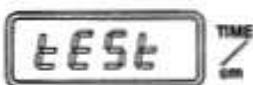
Biopsy abdomen guard
Should be used during the biopsy procedure.

4 SWITCHING THE UNIT ON

On/off switch



The on/off switch is located on the base behind the fixed column. When the power is switched on the unit will carry out a self-test, it lasts about 10 seconds, during which the unit automatically checks itself.



When the self-test is satisfactorily completed a message indicating this will appear briefly on the keypad display.



The current time will then appear on the display which indicates that the unit is ready to use.

NOTE



If the characters shown opposite appear on the display instead of the time it indicates that the unit was in the magnification position when it was switched off.



Press this key to return the cassette table to the contact view position. The time will appear on the display.

NOTE



If the indicator light on this key starts to flash when the unit is switched on it indicates that the unit was in the load position when it was switched off. Load the cassette and then press this key to drive the cassette table to the ready position.

NOTE



If the letters Er (error) and a number (error number) appear on the display it means that there is something wrong with the unit and it did not pass the self-test. Refer to section 13 "ERRORS AND ERROR MESSAGES" on page 53.

NOTE

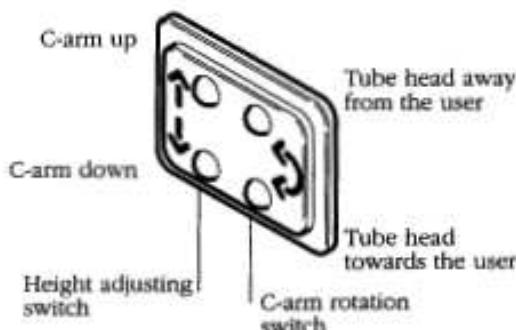


If the word STOP appears on the display it indicates that one or both of the emergency stop buttons on the foot controls have been pushed down. Pull the button or buttons up to clear the display and allow the unit to operate.

5 THE CONTROLS

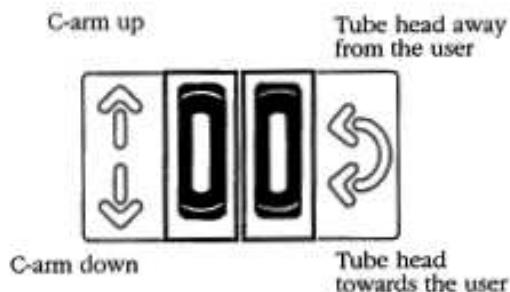
This section describes where the controls are and how they are used.

5.1 C-ARM SIDE PANEL AND CASSETTE TABLE SWITCHES



On both sides of the C-arm there are a pair of switches. The switch on each side towards the front of the tube head changes the angle of the C-arm after the exposure view is selected (the viewing angle value is flashing). Pressing the upper part of the switch will rotate the tube head away from the user, and pressing the lower part of the switch will rotate the tube head towards the user.

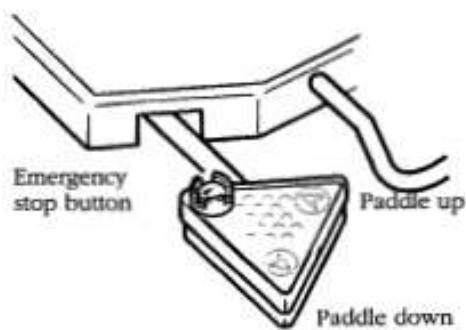
The switches towards the rear of the tube head adjust the height of the unit by moving the C-arm up or down (the height can also be adjusted using the arrow keys on the keypad).



A pair of switches with the same functions are located also on the both sides of the cassette table.

NOTE *In some countries units are set so that the C-arm will not move up or down when the patient's breast is compressed.*

5.2 FOOT CONTROLS



There are two foot controls, one on each side of the base, which are used to move the compression paddle up and down and to stop the unit operating in an emergency. The foot controls can be slid out and individually positioned.

Pressing and holding down the inner corner of either foot control will drive the compression paddle up, and pressing and holding down the outer corner of either foot control will drive the paddle down. Note that the compression paddle can be moved up at any time but will only move down after the breast to be x-rayed has been selected and the C-arm is in the required view position.

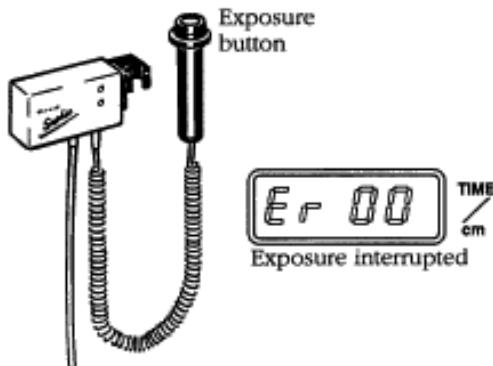
The foot controls can be used to stop the unit while it is moving to the view position. Press either side of the foot control once to stop the C-arm moving and a second time to start it moving again.

NOTE *In some countries units are set up so that the C-arm will not automatically move to the view selected when the view key is pressed. To start, and stop, the C-arm moving the foot control must be pressed. See section 7.2 "BREAST AND VIEW SELECTION" on page 24.*

The foot controls can also be used to stop the unit when it is moving to or from the transportation position, see section 11 "TRANSPORTING THE UNIT" on page 48.

Mounted on the top of both foot controls is an emergency stop button. Press either one to stop the unit operating. The message **StOP** will appear on the display. Pull the stop button up to start the unit again.

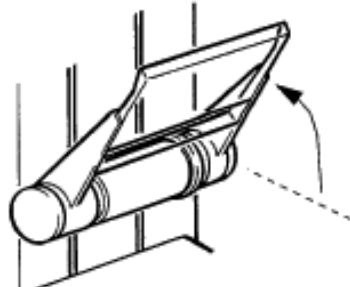
5.3 EXPOSURE CONTROL



The exposure button and holder will be installed at a safe distance from the unit. The distance will depend on the local radiation safety regulations. When you take an exposure you must hold the exposure button down for the duration of the exposure. If the button is released before the exposure is complete the error code **Er 00** will appear on the display. Refer to section 13 "ERRORS AND ERROR MESSAGES" on page 53 for information on how to clear the error message.

There are two indicator lights on the exposure control holder. The green (lower) one will come on when the unit is ready to compress the breast, and the yellow (upper) one will come on when you take an exposure.

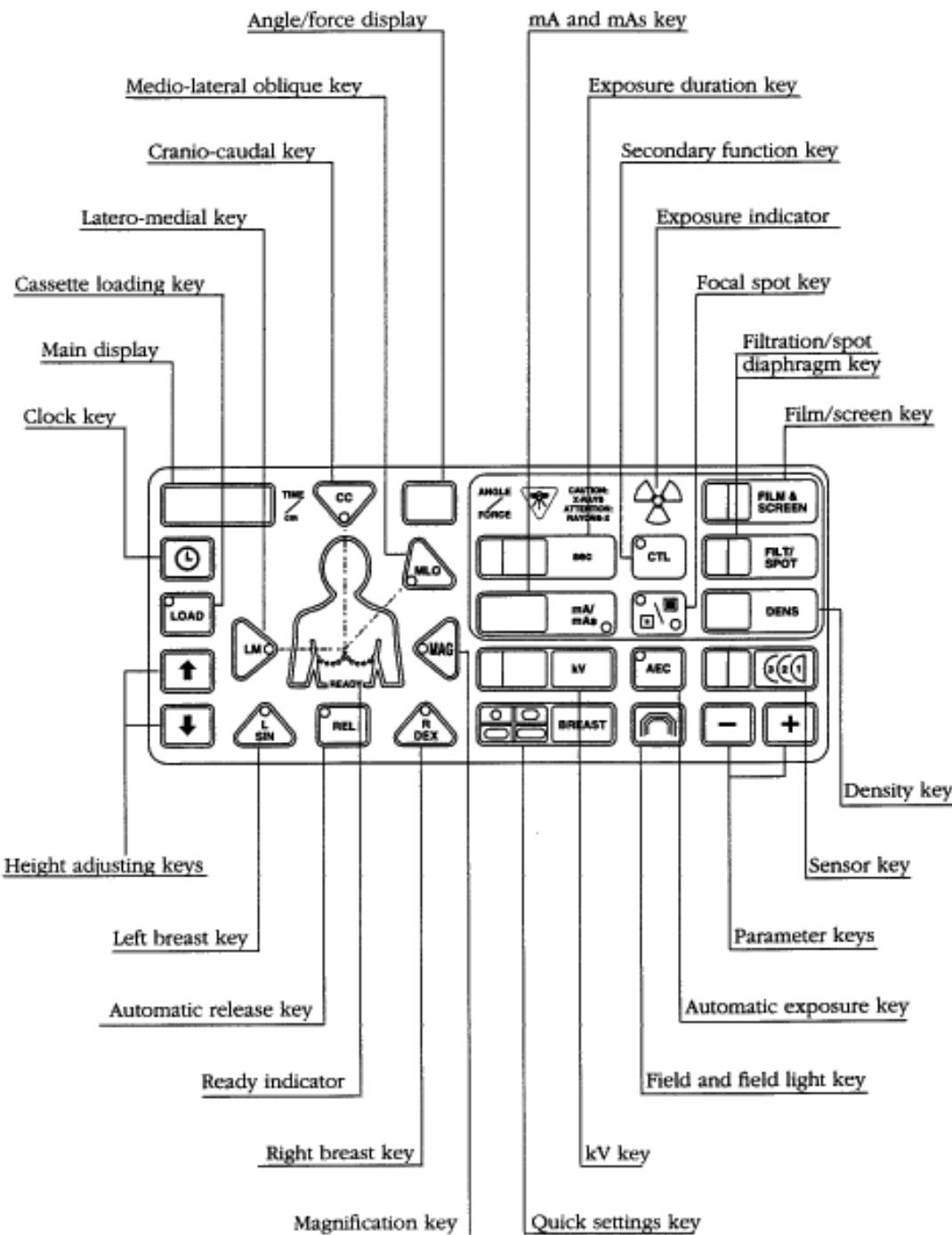
5.4 PADDLE SAFETY RELEASE



This safety feature automatically releases the upper paddle if the compression force becomes too great. To return the paddle to its normal position simply push the paddle back down again. The release force is set at the factory to a standard value, and in normal circumstances does not need to be adjusted. However, if it needs to be adjusted contact your sales representative.

5.5 THE CONTROL PANELS

There are two control panels one on each side of the unit. They are identical and either, or both of them can be used to operate the unit.



5.6 CHANGING PARAMETERS



Press to activate



Press to change

NOTE *The length of time that the value on the display will flash can be altered, see section 10.12 "ADJUSTING THE DURATION OF THE PARAMETER TIME-OUT" on page 44.*

To increase the value press the (+) key, and to decrease the value press the (-) key.



Press to accept

To accept the new value either press the parameter key a second time or wait until the number on the display stops flashing. This indicates that the new, or existing value has been accepted.

5.7 THE KEYS AND DISPLAYS

MAIN DISPLAY



In standby use the current time will be displayed. In operation the distance between the compression paddles (breast thickness), in centimeters or magnification factor will appear on the display, or if there is a fault an error code. After taking an exposure a waiting time will appear on the display which indicates the delay before the next exposure can be taken.

PARAMETER CHANGING KEYS



Press either of these keys to change the settings and parameters. Changing parameters is described in section 5.6 "CHANGING PARAMETERS" on page 9.

CLOCK KEY



Press this key once and the day and month will appear on the display. Press the key a second time and the year will appear. Wait a few seconds or press the key a third time to return to the current time.

CASSETTE LOADING KEY

Press this key (**press and hold this key down if a patient's breast is being compressed**) to move the cassette table to the loading or ready position depending on the original position. When the indicator light is on the cassette table is in the loading position and when the indicator light is off the cassette table is in the ready position. As the cassette table moves to either position the indicator light will flash.

HEIGHT ADJUSTING KEYS

Press either of these keys to adjust the height of the C-arm. Note that it will move slowly at first and then accelerate. You can also adjust the height with the cassette table keys. The speed at which the unit moves up and down can be changed if required. Contact your service technician.

NOTE *In some countries units are set so that the C-arm will not move up or down when the patient's breast is compressed.*

AUTOMATIC COMPRESSION RELEASE

Press this key after taking an exposure to release the compression paddle. To minimize patient discomfort you can set the paddle to automatically release immediately after an exposure has been taken. See section 6.6 "AUTOMATIC PADDLE RELEASE" on page 20. When the indicator light is on automatic paddle release is activated and when the light is off the automatic paddle release is not activated.

LEFT BREAST KEY

Press this key if you wish to take an exposure of the left breast. The indicator light will come on.

RIGHT BREAST KEY

Press this key if you wish to take an exposure of the right breast. The indicator light will come on.

CRANIO-CAUDAL KEY



Select the breast to be exposed before choosing the viewing angle. Press this key to select the cranio-caudal viewing angle. The indicator light will come on and the C-arm will rotate to this position if it is not already there. The posterior-anterior viewing angle can also be selected using this key, see section "10.10 POSTERIOR-ANTERIOR VIEWING ANGLE" on page 42.

NOTE *In some countries units are set up so that the C-arm will not automatically move to the view selected when the view key is pressed. To start, and stop, the C-arm moving the foot control must be pressed. See section 7.2 "BREAST AND VIEW SELECTION" on page 24.*

LATERO-MEDIAL (MEDIO-LATERAL) KEY



Select the breast to be exposed before choosing the viewing angle. Press this key to select the latero-medial viewing angle. The indicator light will come on and the C-arm will rotate to the horizontal position, either to the left or the right depending on which breast you selected. If you wish to stop the C-arm moving before it reaches the correct position press the key a second time. Press the key a third time to start the C-arm moving in the same direction again.

To select the medio-lateral view press and hold this key for three seconds, the light will start to flash and the C-arm will rotate to the position selected. If you wish to stop the C-arm moving press the key a second time. To start the C-arm moving in the same direction again press and hold the key for three seconds.

NOTE *In some countries units are set up so that the C-arm will not automatically move to the view selected when the view key is pressed. To start, and stop, the C-arm moving the foot control must be pressed. See section 7.2 "BREAST AND VIEW SELECTION" on page 24.*

MEDIO-LATERAL (LATERO-MEDIAL) OBLIQUE KEY



Select the breast to be exposed before choosing the viewing angle. Press to select the medio-lateral oblique viewing angle. The indicator light will come on and the C-arm will rotate to the angle previously used, either to the left or the right depending on which breast you selected. The angle will appear on the angle/force display. If you wish to stop the C-arm moving before it reaches the correct position press the key a second time. Press the key a third time to start the C-arm moving in the same direction again.

To select the lateral-medial oblique view press and hold this key for three seconds, the light will start to flash and the C-arm will rotate to the position selected. If you wish to stop the C-arm moving press the key a second time. To start the C-arm moving in the same direction again press and hold the key for three seconds.

If you wish to check the angle to which the C-arm will move before rotation press the key BEFORE YOU SELECT THE BREAST TO BE EXPOSED. The angle will appear on the angle/force display.

NOTE *In some countries units are set up so that the C-arm will not automatically move to the view selected when the view key is pressed. To start, and stop, the C-arm moving the foot control must be pressed. See section 7.2 "BREAST AND VIEW SELECTION" on page 24.*

READY INDICATOR LIGHT

READY

Will come on when the cassette is correctly positioned, the breast and viewing angle have been selected, and the C-arm is in the correct position and indicates that the unit is ready to compress the breast.

Note that the green indicator light on the exposure control holder will also come on.

MAGNIFICATION KEY



Press to select the magnification mode. The small focus and appropriate mA range will be selected and the C-arm will move to the magnification position. The magnification is factory set to 1.7 but can be easily changed, see section 10.9 "SETTING THE MAGNIFICATION FACTOR" on page 42. As the C-arm moves the indicator light will flash and the magnification will appear on the main display. If you wish to stop the C-arm before it reaches the preset magnification position press the key again.

NOTE *When you press this key to start the C-arm moving again it will move in the opposite direction. To continue moving in the same direction stop and then start the C-arm again. To exit the magnification mode press the key again and the C-arm will return to the normal position.*

kV KEY AND DISPLAY

Allows you to select the kV value. Press the key and the display value will start to flash. Select the kV value with the parameter changing (+ or -) keys, the kV value is adjustable from 20 to 35 kV in steps of 1kV. Press the kV key to accept the new value or wait until the display stops flashing.

QUICK SETTINGS KEY AND INDICATORS

The unit is preprogrammed with 4 sets of exposure parameters that can be quickly selected by pressing this key. Selecting the quick exposure settings is described in section 10.7 "QUICK EXPOSURE SETTINGS - SELECTION" on page 41.

AUTOMATIC EXPOSURE CONTROL KEY

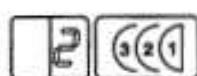
This key is used to switch the AEC (automatic exposure control) modes on and off. There are two AEC modes, conventional AEC and the advanced AEC (AAEC). When the indicator light is on the conventional AEC mode is activated and when the indicator light is flashing the AAEC mode is activated. For information on how to select the AEC modes see section 10.2 "SELECTING THE AEC MODE" on page 57.

SENSOR POSITIONING KEY AND DISPLAY

If you are using the AEC mode you must select the position of the radiation sensor according to the size of the patient's breast. Press the key and the display value will start to flash. Select the sensor you require with the parameter changing (+ or -) keys, the numbers refer to the markings and numbers on the compression paddles. You can also change the sensor by pressing the sensor positioning key.



Position 1 indicates that the sensor is close to the chest wall and is normally used for taking exposures in the oblique view and with patients with small breasts.



Position 2 is normally used for taking exposures in the cranio-caudal and lateral views.



Position 3 is normally used for taking exposures in the cranio-caudal and lateral views of patients with large breasts. Note that this position cannot be selected in the spot mode.

Press the key again to accept the new value or wait until the display stops flashing.

DENSITY KEY AND DISPLAY

Allows you to select the film density, see section 6.8 "ADJUSTING THE FILM DENSITY" on page 22. It will only function when you are taking exposures in the AEC mode. Note that the film processor, and processing chemicals will affect the film density.

FILM/SCREEN COMBINATION KEY AND DISPLAY

This key allows you to select different combinations of film and screen. Selecting film/screen combinations is described in section 6.1 "CHECKING AND CHANGING THE FILM/SCREEN COMBINATION" on page 17.

FILTRATION/SPOT MODE KEY AND DISPLAY

Allows you to select different filters. Press the key and the display value will start to flash. Select the filter with the parameter changing (+ or -) keys.



The small square symbol indicates that the spot collimator, with 30 μ thick molybdenum, has been chosen. The small focal spot is automatically selected. The spot paddle should be used with the spot collimator.



Filter number 1 is 30 μ m thick molybdenum and can be used with any kV value.



Filter number 2 is 0.5mm thick aluminum and can only be used with kV values of 30 and above. Note that you may have to reduce the mA or mAs value in order to use kV values of 30 and over.

NOTE *The advanced AEC mode can not be used with the aluminum filter.*



Filter number 3 is 25 μ m thick rhodium and can only be used with kV values of 27 and above. Note that you may have to reduce the mA or mAs value in order to use kV values of 27 and over.

NOTE *The X-ray unit is equipped with either the aluminum filter or the rhodium filter.*

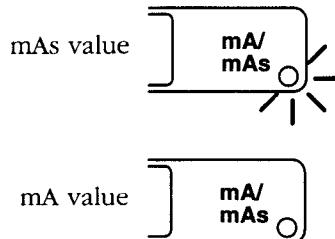
Press the key again to accept the new setting or wait until the display stops flashing.

FOCAL SPOT KEY AND INDICATOR



Press this key to change the focal spot size. When the right-hand indicator light is on it indicates that the large focal spot has been selected and when the left-hand indicator light is on it indicates that the small focal spot has been selected. The large focal spot is normally used for contact view procedures, and the small focal spot for more detailed diagnostic procedures. Note that when you wish to change from the large focal spot to the small spot the key must be pressed and held down. This does not apply when you are in the magnification mode.

mA AND mAs KEY AND DISPLAY

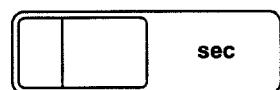


The mA and mAs values can only be selected when the unit is used in the manual mode. Taking exposures in the manual mode is described in section 10.5 "MANUAL EXPOSURE PROCEDURE" on page 39.

To select an mA or mAs value, or vice versa, press and hold this key until the indicator light comes on or goes out depending on the original setting. When the indicator light is on mAs values will be used and when it is off mA values will be used. To change an mA or mAs value press the key and the display value will start to flash. Change the value with the parameter changing (+ or -) keys.

The mAs value is adjustable from 10 to 500 (in some areas the maximum mAs value is 300 or 600) with the large focus and 10 to 200 with the small focus, depending on the kV value selected. The mA value is adjustable from 30 to 110 (in some countries 120) with the large focus and 10 to 26 (in some countries 28) with the small focus. When you have changed the value press the key again to accept the new value or wait until the display stops flashing. If you select an mA value the mAs value will appear on the display after the exposure has been taken. In the AEC (automatic exposure control) mode the mA value is automatically selected and the mAs value will appear on the display after the exposure has been taken.

EXPOSURE DURATION KEY AND DISPLAY



The exposure duration can only be selected when the unit is used in the manual mode, refer to section 10.5 "MANUAL EXPOSURE PROCEDURE" on page 39. Press the key and the display value will start to flash. Select the exposure duration with the parameter changing (+ or -) keys, the exposure duration is adjustable from 0.1 to 5.0 seconds with the large focus, and 0.1 to 9.9 with the small focus, both in steps of 0.1. Press the exposure key to accept the new value or wait until the display stops flashing. In the AEC (automatic exposure control) mode the exposure duration cannot be keyed in but the actual exposure time will appear on the display after the exposure has been taken.

VIEWING ANGLE/COMPRESSION FORCE DISPLAY

Displays the viewing angle in degrees. When the upper compression paddle is in the highest position the angle on the display will flash which indicated that it can be changed by pressing the plus (+) or minus (-) key. During compression it displays the compressive force, in kilograms.

FIELD LIGHT KEY

Press this key to switch the field light on. The light that appears on the cassette table corresponds to the radiation field. The size of the light field, and therefore the radiation field, can be adjusted with the parameter changing (+ or -) keys. The light will stay on for 25 seconds. If you need more time press the key again. The field light will automatically come on when you start compression and can be adjusted with the parameter changing (+ or -) keys.

NOTE *The field size will return to its maximum after exposure.*

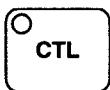
EXPOSURE WARNING INDICATOR

CAUTION:
X-RAYS
ATTENTION:
RAYONS-X



The exposure warning light will come on when you take an exposure. You will also hear two tones during the exposure period. The first tone is the start up tone and the second, a higher tone, is the exposure tone. When the exposure is complete the tone will stop.

Note that the yellow indicator light on the exposure control holder will also come on.

SECONDARY FUNCTION KEY

Press this key to activate the special function mode. The indicator light will come on. The key is also used to clear error codes from the display.

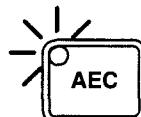
6 PREPARING THE UNIT

This section explains how to prepare the unit for your particular requirements. In normal circumstances this preparation work only needs to be done if you are using the unit for the first time, changing compression paddles or if you are going to carry out some special procedures.

6.1 CHECKING AND CHANGING THE FILM/SCREEN COMBINATION

The unit is factory set to use a particular film/screen combination. This combination can be checked and changed if required

Switch the unit on.



Press this key to switch the AEC mode on if it is not already on.



Check that the number that appears on the film/screen display is correct for the film and screen you are using or plan to use. A list of film/screen combinations is given below. If the number is not correct it must be changed.



Press and hold down (two seconds) this key to activate the film /screen selection mode. The film/screen combination number will start to flash.



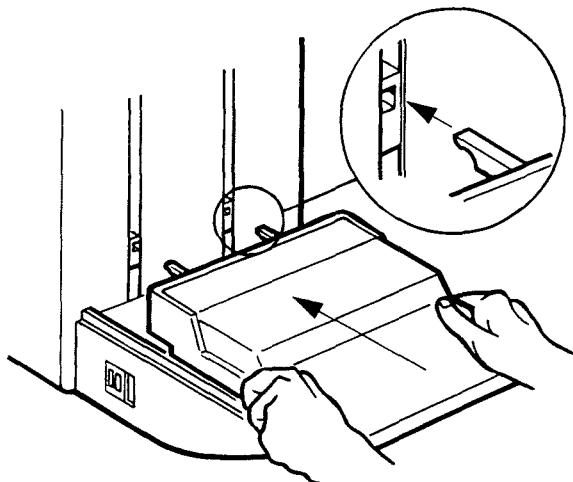
Press either of these keys to select the film/screen combination that you require. If the film/screen combination you wish to use is not listed contact your sales representative for advice.

NUMBER	FILM	SCREEN
0	This number is reserved for special user selectable film/screen combinations. Contact your sales representative for further information	
1	Kodak MIN-RE	Kodak MIN-R
2	Dupont Microvision	Dupont Orthomicro
3	Fuji MiMA M1	Fuji HR Mammofine
4	Kodak MIN-RE	Kodak MIN-R medium
5	Agfa MR 3 II	Agfa MR detail
6	Kodak MIN-RE	Fuji HR Mammofine
7	Konica CM	Konica M100
8	Dupont Microvision	Konica M100
9	Kodak MIN-RE	Agfa MR detail S
5	Agfa MR 3 II	Agfa MR detail S
6	3M Trimax HM	3M Trimax 2M
7	Dupont Microvision	Kodak MIN-R
8	Dupont Microvision	Kodak MIN-R medium
9	Kodak MIN-RH	Kodak MIN-R



Press this key to enter the new film/screen combination into the memory. You can also wait until the number stops flashing which indicated that the new value has been automatically placed in the memory.

6.2 REMOVING AND REPLACING THE LOWER COMPRESSION PADDLE



Select the correct size of lower paddle according to the cassette you plan to use. There are two sizes of lower paddle 18 x 24cm and 24 x 30cm. These must be used with the cassettes of the same size.

To place the lower paddle in position slide the two prongs at the rear of the paddle into the corresponding holes in the C-arm.

To remove paddle pull it towards you to disengage the prongs.

NOTE *You only need to use the lower paddle when you are taking spot or magnification views or performing a biopsy.*

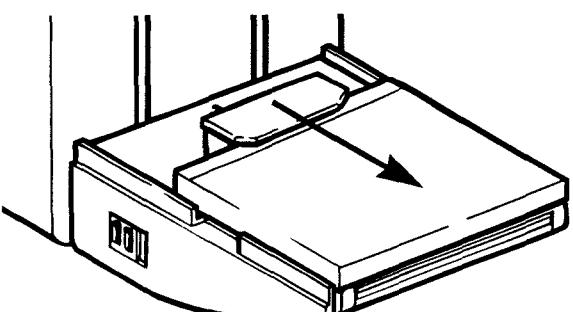
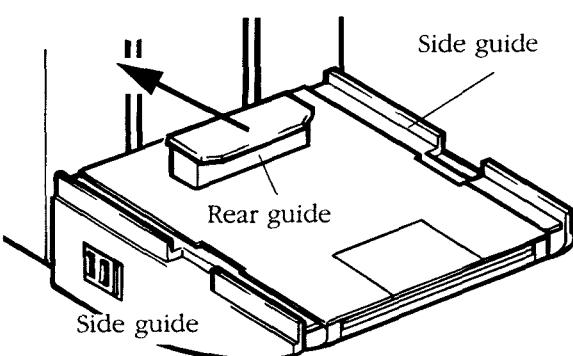
6.3 ADJUSTING THE CASSETTE TABLE

The unit has been factory set to use **either** a MIN-R cassette **or** a MIN-R2 daylight cassette. If you wish to change from one **type of cassette** to the other you will need to call a service technician to adjust the unit.

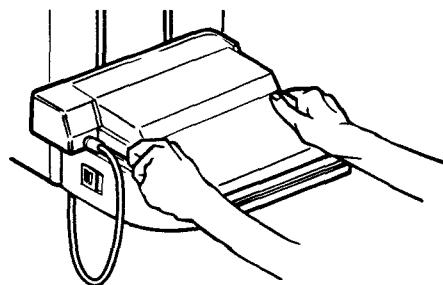
To change the cassette **size** remove the lower compression paddle if it has not already been removed.

Select the size of cassette you wish to use, either 18 x 24cm or 24 x 30cm.

Slide the rear guide on the cassette table backwards as far as it will go, the side guides will automatically move out.



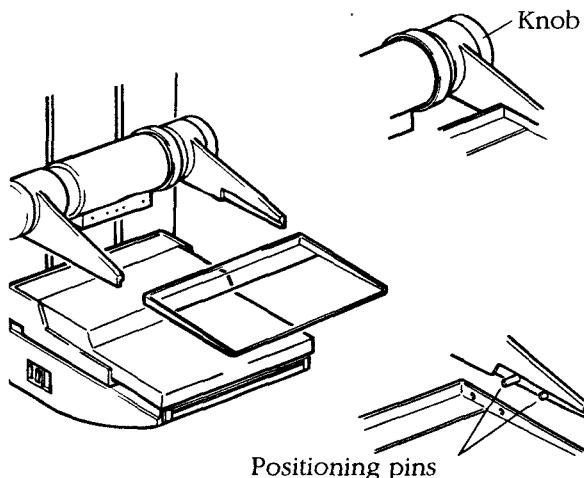
Place the cassette on the cassette table and slide the rear guide forwards until it touches the cassette. The two side guides will automatically slide in and center the cassette. Make sure that the cassette is located under the step at the front of the rear guide and that the edges of the side guides touch the sides of the cassette. The radiation beam collimator and the radiation field light will be automatically adjust to suit the cassette being used.

6.4 BUCKY DEVICE

The Bucky grid system replaces the lower compression paddle. It is installed in the same way as the lower paddle. When the Bucky device is in place connect the plug at the end of the cable that is attached to the device to the connector on the under side of the cassette table. The Bucky grid is now ready to use. There are two sizes of Bucky grid, 18 x 24cm or 24 x 30cm

When taking manual exposures with the Bucky grid use exposure values two kV higher than exposures taken without the Bucky. When taking automatic exposures with the Bucky grid the kV value will be automatically corrected.

6.5 REMOVING AND REPLACING THE UPPER COMPRESSION PADDLE



Remove the upper paddle by turning the knob on the right-hand side of the paddle frame counterclockwise and replace it with the paddle you intend to use. Note that the pins on the inside of the paddle frame locate in the corresponding holes in the sides of the paddle. Secure the paddle in place by turning the knob clockwise. Do not over tighten it.

6.6 AUTOMATIC PADDLE RELEASE

To minimize patient discomfort you can set the upper paddle to automatically open immediately after an exposure has been taken.

NOTE *This MUST not be activated if a biopsy is to be taken.*



Press this key to activate the secondary function mode. The indicator light will come on.

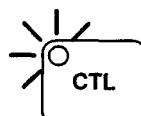


Press this key to activate or disable the automatic paddle release, depending on the original setting. The indicator light will come on when the automatic paddle release is on.

If you wish to cancel the automatic paddle release repeat the above procedure.

6.7 SELECTING THE COMPRESSION METHOD

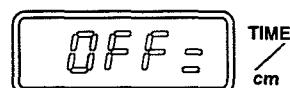
Two methods of compression are possible. Conventional compression where the paddles are parallel to each other during compression, and two phase compression (TWINCOMP) where the upper paddle is tilted downwards at the beginning of the compression stage and levels as the compression increases.



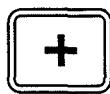
Press this key to select the secondary functions. The indicator light will come on.



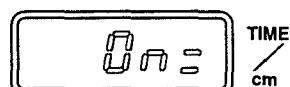
Press and hold down this key until one of two messages appears on the main display. The message will depend on which compression method is being used.



This message indicates that the conventional compression procedure is being used, the TWINCOMP procedure is switched off.



Press this key to change to the TWINCOMP compression procedure if required.



This message indicates that the TWINCOMP compression has been switched on. The paddle will automatically tilt down when you start compression.



Press this key to change to the conventional compression procedure if required.



Press this key to accept the new or existing compression procedure.

NOTE *TWINCOMP compression can be manually selected if it is not set to operate automatically. Simply push the front edge of the compression paddle to tilt it down into the TWINCOMP position.*

6.8 ADJUSTING THE FILM DENSITY

The density of the film can be adjusted if required. It can only be adjusted in the AEC mode. Note that the type of film processor, processing chemicals and temperatures used will affect the film density.



Press the key and the display value will start to flash.



Select the density with the parameter changing (+ or -) keys. The density level has 15 steps from -7 (light exposures) to +7 (dark exposures) with each step representing a 13% change in density.



Press the key again to accept the new value or wait until the display stops flashing.

7 CONTACT VIEW PROCEDURE

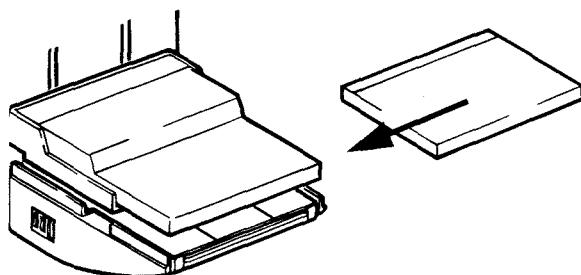
The following section describes how to take exposures with the unit using the AEC (automatic exposure control) mode. For information on how to take exposures manually see section 10.5 "MANUAL EXPOSURE PROCEDURE" on page 39.

7.1 SETTING THE EXPOSURE VALUES

Switch the unit on.



Press this key to move the cassette table to the loading position. The indicator light will flash as the cassette table moves. When the cassette table stops moving the light will stay on.



Place the cassette on the cassette table from either side of the unit. Make sure that you do not push the rear guide out of position and that you place the cassette on the table the right way round.



Press this key to move the cassette table back to the ready position. The indicator will flash until the cassette table stops moving and will then go out.

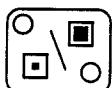


Press this key to select automatic exposure control (AEC) mode if it is not already selected. The indicator light will either come on or start to flash depending upon the previously used AEC mode.

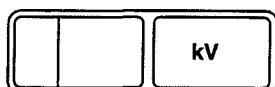
If the indicator light comes on it indicates that the conventional AEC mode is activated and if the indicator light starts flashing it indicates that the AAEC mode is activated.

With conventional AEC the correct kV must be selected before exposure, and with the AAEC mode a kV value will be automatically selected before, and adjusted during, the exposure. For information on how to select the AEC modes see section 10.2 "SELECTING THE AEC MODE" on page 37.

When the AEC mode has been selected the correct mAs value and exposure time will appear on their respective displays.



Select the focal spot you require. The appropriate indicator light will come on. Remember that if you wish to change from the large focal spot to the small spot the key must be pressed and held down.



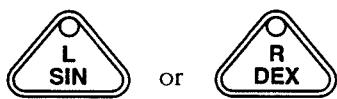
If you are using the conventional AEC mode select the kV value required for the patient to be examined.

NOTE *You can set the unit so that it will automatically display a recommended kV value after the breast has been compressed. See section 10.1 "AUTOMATIC kV SELECTION" on page 36.*

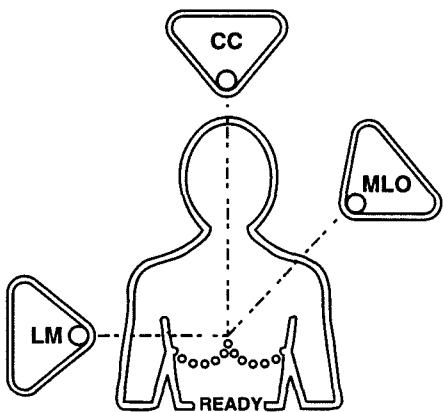


Make sure that filtration you are using is appropriate for the kV value that you have selected. If necessary change the filtration.

7.2 BREAST AND VIEW SELECTION



Select the breast to be examined by pressing the appropriate key. The corresponding indicator light will come on. The L and R on the keys refer to the patient's left and right.

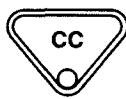
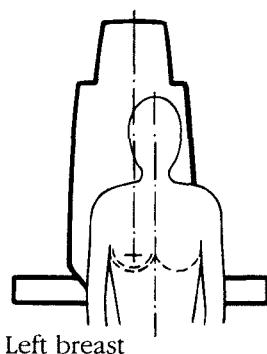


Select the exposure view you require by pressing one of the view keys. The different views are explained below. The corresponding indicator light will come on and the C-arm will move to the view selected if it is not already in that position. If you wish to stop the C-arm moving press the key again. If you chose the wrong view press the correct view key and the C-arm will move to the new view.

NOTE *In some countries units are set up so that the C-arm will not automatically move to the view selected when the view key is pressed. To move the C-arm to the view selected press and hold down the foot control. To stop the C-arm moving remove your foot from the foot control.*

The film marking system will automatically print the selected breast and view information at the top of the film. The automatic film marking system can be switched off, see section 10.15 "SWITCHING THE FILM MARKING SYSTEM ON AND OFF" on page 45.

Cranio-caudal view



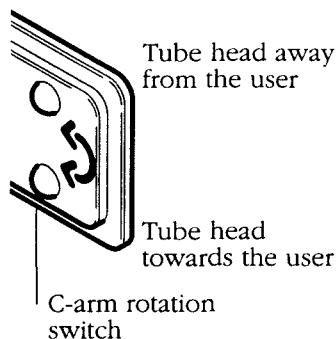
Press this key if you wish to select the cranio-caudal view. The C-arm will remain in the vertical position or move to the vertical position from one of the other views.

R
CC

Film marking for the right breast

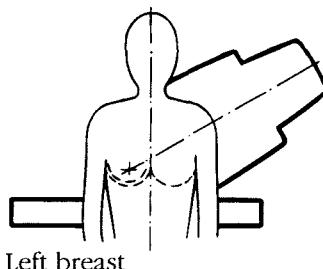
C
L

Film marking for the left breast



The cranio-caudal viewing angle can be adjusted with the cassette table or C-arm side panel switches. The C-arm can be moved up to approximately 15° in both the clockwise and the counterclockwise direction. The new angle will appear on the angle/force display.

Medio lateral oblique view



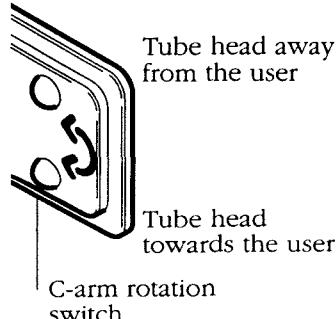
Press this key if you wish to select the medio-lateral oblique view. The C-arm will rotate to the angle previously selected, either to the left or the right, depending on which breast you have selected. The indicator light will come on and the angle will appear on the angle/force display and start to flash. Setting the preset angle is described in section "10.4 SETTING THE OBLIQUE VIEW ANGLE" on page 38.

R
MLO

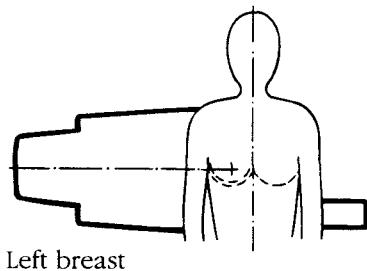
Film marking for the right breast

L
MLO

Film marking for the left breast



The C-arm angle can be adjusted with the cassette table or C-arm side panel switches. The angle can be set between 15° and 75°. The new angle will automatically replace the angle previously stored in the memory and appear on the angle/force display.

Latero-medial view

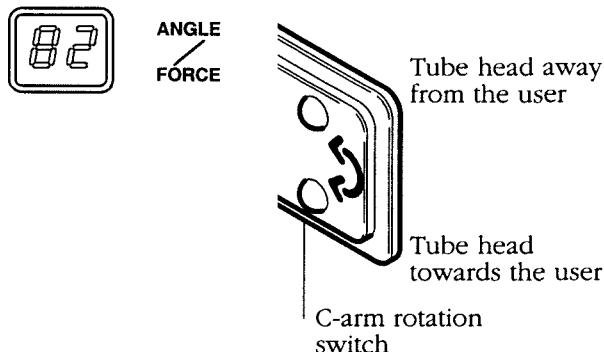
Left breast

**LM90****L**

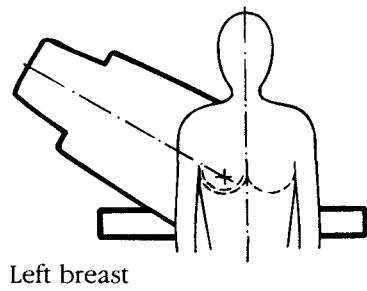
Press this key if you wish to select the latero-medial view. The C-arm will rotate to the horizontal position, either to the left or right depending on which breast you selected. The indicator light will come on and the angle will appear on the angle/force display and start to flash.

Film marking for the right breast

Film marking for the left breast



The latero-medial viewing angle can be adjusted with the cassette table or C-arm side panel switches. The C-arm can be moved up to approximately 15° in both the clockwise and the counterclockwise direction. The new angle will appear on the angle/force display.

Latero-medial oblique view

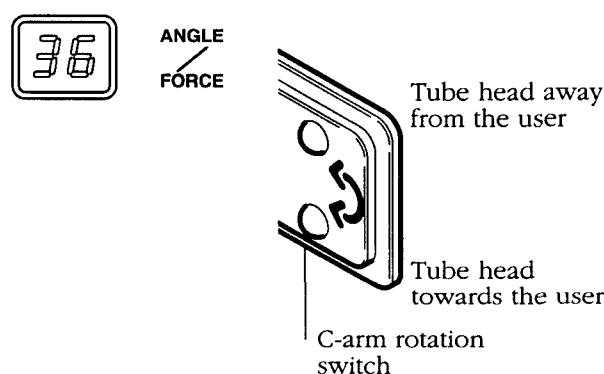
Left breast

**MR****ML**

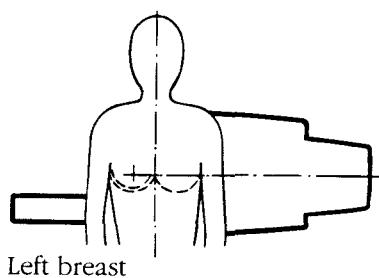
Press and hold this key down for three seconds if you wish to select the latero-medial oblique view. The C-arm will rotate to the angle previously selected, either to the left or the right, depending on which breast you have selected. The indicator light will come on and the angle will appear on the angle/force display and start to flash. Setting the preset angle is described in section "10.4 SETTING THE OBLIQUE VIEW ANGLE" on page 38.

Film marking for the right breast

Film marking for the left breast



The C-arm angle can be adjusted with the cassette table or C-arm side panel switches. The angle can be set between 15° and 75°. The new angle will automatically replace the angle previously stored in the memory and appear on the angle/force display.

Medio-lateral view

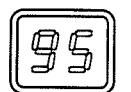
R
ML90

L
ML90

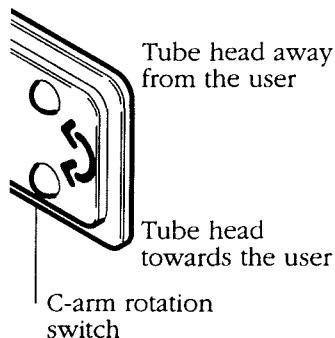
Press and hold this key down for three seconds if you wish to select the medio-lateral view. The C-arm will rotate to the horizontal position, either to the left or right depending on which breast you selected. The indicator light will come on and the angle will appear on the angle/force display and start to flash.

Film marking for the right breast

Film marking for the left breast

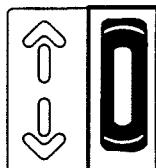


ANGLE
FORCE

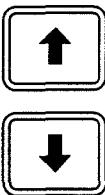


READY

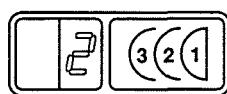
The READY lights on the control panel and the exposure control holder will come on when the cassette is correctly loaded, the breast and viewing angle have been selected, and the C-arm is in the correct position.



or



Adjust the height of the unit to suit the patient. The height can also be adjusted with the cassette table switches.



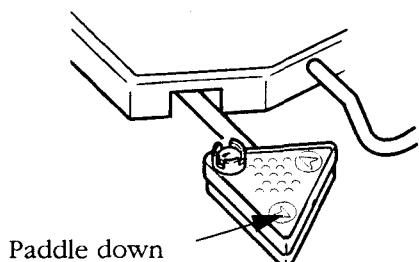
Select the radiation level sensor according to the exposure view selected and the build of the patient. The display numbers correspond to the numbers and markings on the compression paddles.

8 BREAST COMPRESSION PROCEDURES AND TAKING AN EXPOSURE

The unit offers two methods of breast compression. Conventional compression where the paddles are parallel to each other during compression, and two-phase compression (TWINCOMP) where the upper paddle tilts down at the beginning of the compression stage and levels as the compression increases. Compression method selection is described in section 6.7 "SELECTING THE COMPRESSION METHOD" on page 21.

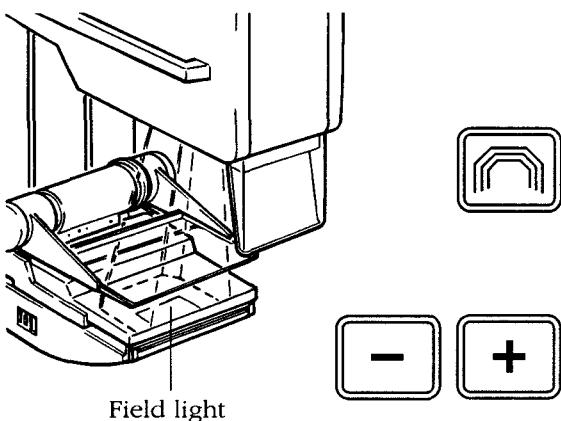
8.1 BREAST COMPRESSION - CONVENTIONAL PROCEDURE

Position the breast to be examined on the lower paddle, or cassette table if the paddle is not being used. The chest below the breast should be pressed against the front edge of the cassette table. Manipulate and spread the breast forwards and outwards as much as possible on the lower paddle.



Slide the foot control out to a suitable position and then start compression by pressing the outer corner of either foot control. The field light will automatically come on. The upper compression will start to descend while remaining parallel to the lower paddle. During this phase of the breast compression the maximum limit (in kilograms) at which the compressive force is set will appear on the angle/force display and start to flash.

If you wish to stop compression stop pressing the foot control or cassette table switches. To continue compression press either control again.

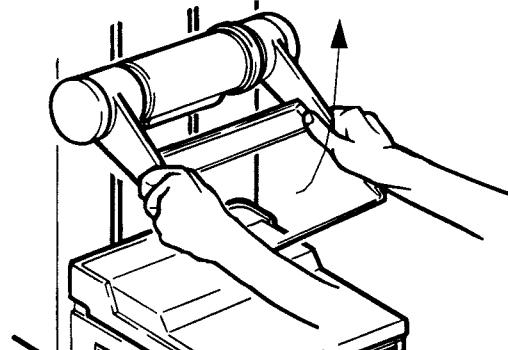
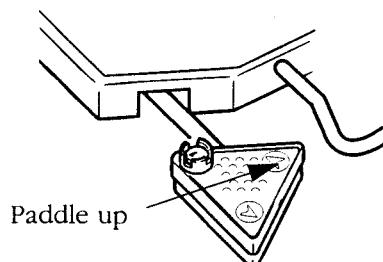


Adjust the size of the radiation field if necessary.

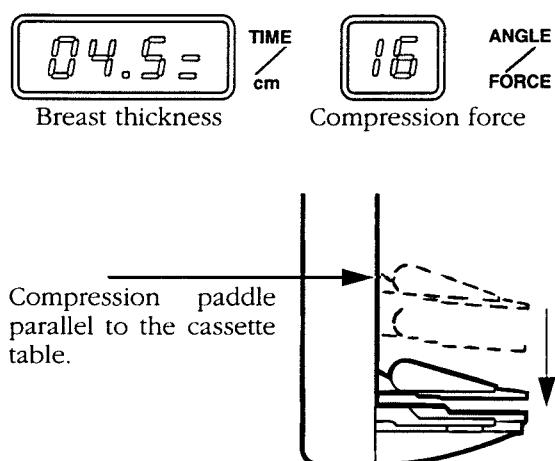
To do this press this key to switch the radiation field light on.

Adjust the size of the field by pressing either of these keys.

If you wish to move the paddle upwards press the other side of the foot control.



NOTE *If the paddle inadvertently tilts down into the TWINCOMP compression position it can simply be lifted back manually into the conventional position.*



As you start to compress the patient's breast the compressive force stop limit will clear from the display and be replaced with the actual compressive force (in kilograms). The distance (in centimetres) between the two paddles, breast thickness, will appear on the main display. When the compressive force reaches the preset limit you will hear a tone and compression will stop. To continue compression stop and then start pressing the compression control again. The paddle will start to descend again this time, however, at a slower speed. To adjust the speed of compression refer to section 10.11 "SETTING THE SPEED OF MOVEMENT OF THE COMPRESSION PADDLE" on page 43.

8.2 BREAST COMPRESSION - TWO-PHASE (TWINCOMP) COMPRESSION

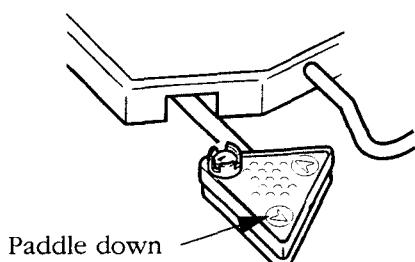
With two-phase compression the upper paddle starts compression at an angle and levels as the breast is compressed.



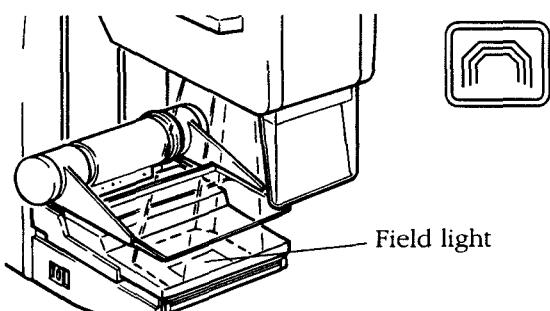
If automatic paddle release is not activated press this key to drive the upper compression paddle to its highest position. The foot controls or cassette table switches can also be used.

BREAST COMPRESSION PROCEDURES AND TAKING AN EXPOSURE

Position the breast to be examined on the lower paddle, or cassette table if the paddle is not used. The chest below the breast should be pressed against the front edge of the cassette table. Manipulate and spread the breast forwards and outwards as much as possible on the lower paddle.

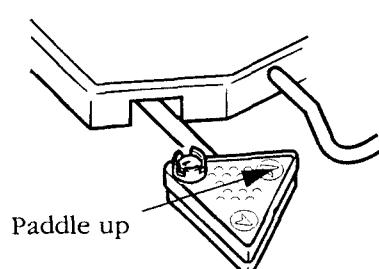


Slide the foot control out to a suitable position and then start compression by pressing the outer corner of either foot control. The upper compression paddle will automatically tilt down into the TWINCOMP position as compression starts. The paddle can also be tilted down manually by gently pushing the front edge of the paddle down.

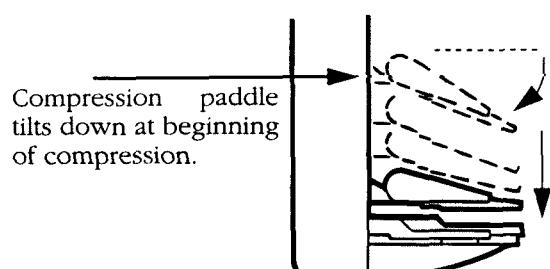


If you wish to stop compression stop pressing the foot control or cassette table switches. To continue compression press either control again.

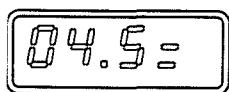
Adjust the size of the radiation field if necessary.



If you wish to move the paddle upwards press the other side of the foot control.



The paddle is angled downwards at the start of compression. During this phase of the breast compression the maximum limit (in kilograms) at which the compressive force is set will appear on the angle/force display and start to flash. As the paddle descends and starts to compress the breast, it begins to level and exert a force on the breast which not only compresses the breast but also tends to pull the breast tissue away from the chest and remove skin folds. Also, because of the angled upper paddle there is more room between the two paddles to manipulate the breast at the start of the compression stage. As you continue to compress the breast the upper paddle will level for the final compression stage. As the compressive force increases the speed of compression decreases. This reduces the risk of over compression.



Breast thickness

TIME
cm

Compression force

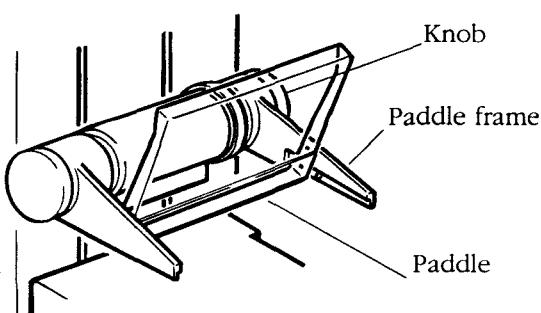
ANGLE
FORCE

As you start to compress the patient's breast the compressive force stop limit will clear from the display and be replaced with the actual compressive force (in kilograms). The distance (in centimetres) between the two paddles, breast thickness, will appear on the main display. When the compressive force reaches a preset limit you will hear a tone and the compression will stop. To continue compression stop and then start pressing the compression control again. The paddle will start to descend again this time, however, at a slower speed. To adjust the speed of compression refer to section 10.11 "SETTING THE SPEED OF MOVEMENT OF THE COMPRESSION PADDLE" on page 43.

8.3 EMERGENCY COMPRESSION RELEASE



To release the compression in an emergency press this key or the foot control or cassette table switch. **Do not press the emergency stop button in this situation as this will stop the unit working.**



If there is a power failure while you are examining a patient the quickest and easiest way to release the upper compression paddle is to turn the knob on the right-hand side of the paddle frame counterclockwise until the compression paddle disengages from the front two positioning pins and swings up.

8.4 TAKING AN EXPOSURE

Before taking an exposure make sure that the patient's head or shoulder does not get in the way of the radiation beam.



Protect yourself from radiation and take an exposure by pressing the remote control button. Note that the button must be held down for the duration of the exposure. If you remove your finger from the exposure button before the exposure is complete an error code will appear on the display. For more information refer to section "13 ERRORS AND ERROR MESSAGES" on page 53.

CAUTION:
X-RAYS
ATTENTION:
RAYONS-X



The exposure warning lights on the control panel and the exposure control holder will come on and you will hear two tones during the exposure period. The first tone is the start up tone and the second, a higher tone, is the exposure tone. When the exposure is complete the tone will stop.

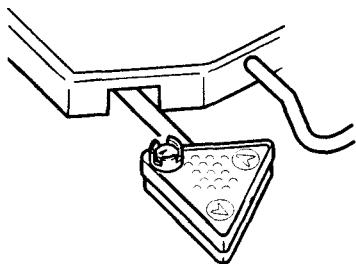
8.5 AFTER EXPOSURE



If the automatic compression release is switched on the upper compression paddle will automatically release after the exposure is completed.



If the automatic compression release is not activated press this key to release the upper compression paddle. It will move automatically to the ready position.



You can also release the upper compression paddle by pressing and holding down the foot control. Note, however, that the paddle will only move as long as you hold the control down, and the paddle will not automatically rise to the ready position.

Guide the patient away from the unit.

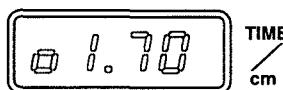
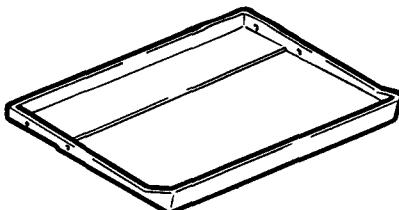
Another exposure can be taken as soon as the time reappears on the display. The delay time will depend on the exposure parameters used.

9 MAGNIFICATION PROCEDURES

The following section describes how to use the unit for assessment work.

9.1 MAGNIFICATION MODE

Instal the appropriate paddle in the paddle frame. Do not over-tighten the frame knob.



Press this key to select the magnification mode. The small focus and appropriate mA range will be automatically selected and the indicator light will flash as the C-arm moves to the preset magnification position. When the magnification position is reached the indicator light will stay on.

If you wish to stop the C-arm moving press the key again.

NOTE *If you wish to temporarily reduce the magnification press the key again and the magnification will start to decrease, in steps of 0.02. Press the key a second time when you reach the magnification you require.*

Load the cassette.

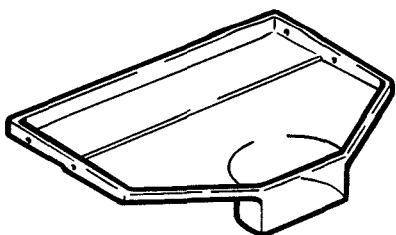
You can now set the exposure parameters, compress the breast, and take an exposure in the same way as described in section 7 "CONTACT VIEW PROCEDURE" on page 23 and section 8 "BREAST COMPRESSION PROCEDURES AND TAKING AN EXPOSURE" on page 28.

If you wish to change the preset magnification factor refer to section 10.9 "SETTING THE MAGNIFICATION FACTOR" on page 42.



Press this key to exit the magnification mode. The C-arm will return to the contact view position and the indicator light will go out.

9.2 SPOT MODE



Install the appropriate spot paddle in the paddle frame. Do not over-tighten the frame knob.

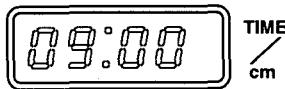


Select the spot mode. In this mode only the area of the spot cone will be exposed.

Load the cassette.



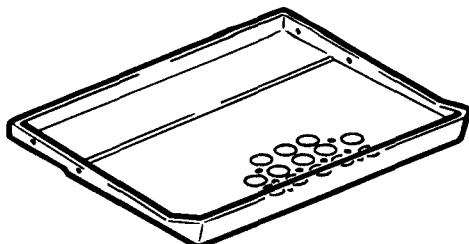
Press this key to select the magnification mode. The small focus and correct mA range will be automatically selected and the C-arm will move to the preset magnification position.



You can now set the exposure parameters, compress the breast, and take an exposure in the same way as described in section 7 "CONTACT VIEW PROCEDURE" on page 23 and section 8 "BREAST COMPRESSION PROCEDURES AND TAKING AN EXPOSURE" on page 28.

Press this key to exit the spot mode. The C-arm will return to the normal position and the indicator light will go out. Also the unit will switch from the spot diaphragm back to the normal field size.

9.3 BIOPSY PROCEDURE



Install the biopsy paddle in the paddle frame. Do not over-tighten the frame knob.



NOTE *Make sure that the automatic compression release is NOT switched on, the indicator light must be off.*

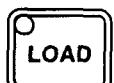
NOTE *MAKE SURE THAT THE PATIENT IS NOT HOLDING THE CASSETTE TABLE WHEN CARRYING OUT THIS PROCEDURE.*



Press this key to drive the cassette table to the loading position and load the cassette.

Note that when the automatic compression release is switched off the cassette table descend to a lower position than when automatic compression release is on.

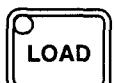
You can now set the exposure parameters, compress the breast, and take an exposure in the same way as described in section 7 "CONTACT VIEW PROCEDURE" on page 23 and section 8 "BREAST COMPRESSION PROCEDURES AND TAKING AN EXPOSURE" on page 28.



After the exposure do not release the compression but press this key to drive the cassette table to the loading position. Remove the cassette, and process the film. The pattern of holes in the perforated paddle will be seen on the film. Localize the position of the lesion and insert the localization wire into the lesion through an appropriate hole in the biopsy paddle.

Take a second exposure.

NOTE *When the patient's breast is compressed this key must be pressed and held down to drive the cassette table up to the ready position.*



CAUTION

Make sure that there is no object between the cassette and the lower compression paddle. If something is in danger to get pinched in between, release the load key to stop the movement. The cassette table will automatically descend slightly.

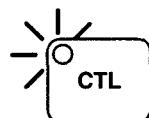
Process the film. If the needle is in the right place take the biopsy. If the needle is not in the right place reposition the needle and take another exposure. Repeat the procedure until the biopsy can be taken.

10 SPECIAL FUNCTIONS

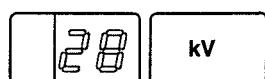
The following section describes the unit's special functions.

10.1 AUTOMATIC kV SELECTION

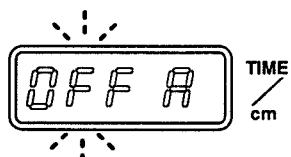
This function automatically selects a recommended kV value after the breast has been compressed. The kV value is based on the thickness of the compressed breast.



To activate this function press this key to select the secondary function mode. The indicator light will come on.



Press this key and one of two messages will appear on the main display and start to flash. The message will depend on whether the automatic kV selection mode was previously switched on or off.

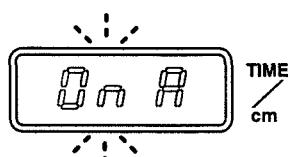


This message indicates that the automatic kV selection mode is switched off.

NOTE *If the advanced AEC mode is selected, the automatic kV selection is on regardless of this setting.*



If you wish to switch the automatic kV selection mode on press this key.



This message indicates that the automatic kV selection mode is switched on.



If you wish to switch the automatic kV selection mode off press this key.



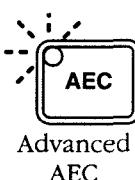
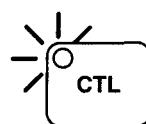
Press this key to accept the new or existing mode.

10.2 SELECTING THE AEC MODE

There are two AEC modes, conventional AEC and advanced AEC (AAEC). With conventional AEC you must select the kV required before taking an exposure.

With advanced AEC kV value is selected after the patient's breast has been compressed and then this value is automatically corrected during the exposure. The kV value is based on the tissue density of the patient's breast.

NOTE *The minimum kV value that can be used in the AAEC mode is set at the factory to a value 20 kV. If it needs to be adjusted contact your sales representative.*



Press this key and the indicator light will either come on or start to flash depending on what AEC mode is activated. If the light comes on it indicates that the conventional AEC mode is activated and if the light starts to flash it indicates that the advanced AEC mode is activated.

To change AEC modes press this key to select the secondary function mode. The indicator light will come on.

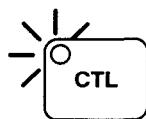
Press this key and the AEC mode will change from the original setting to the new setting. For example from conventional to advanced AEC or advanced to conventional.

NOTE *If the rhodium filter is selected, the advanced AEC can not select kV values below 27kV. The 27kV is used instead.*

10.3 AUTOMATIC RHODIUM/MOLYBDENUM FILTER SELECTION

This function automatically selects the rhodium or the molybdenum filter after the breast has been compressed. The selection is based on the thickness of the compressed breast.

Above the preset breast thickness the rhodium filter is selected. Otherwise the molybdenum is used.



To activate this function press this key to select the secondary function mode. The indicator light will come on.

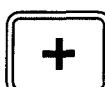
SPECIAL FUNCTIONS



Press and hold this key for 3 seconds. The time/cm display will start to flash.



Press either of these keys to change the breast thickness above which the rhodium filter is selected. The minimum value is 6.6cm and the maximum is 9.9cm.



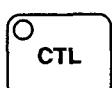
Press this key after the maximum breast thickness (9.9cm) has been reached to switch the automatic rhodium filter selection off.



This message indicates that the automatic rhodium filter selection is switched off.



Press this key to switch the automatic rhodium filter selection on. You can now change the breast thickness with the plus and minus keys.

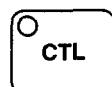


Press this key to accept the new value and exit the secondary function mode.

NOTE *After the patient's breast has been compressed the filter can be changed manually when the filt/spot display is flashing. If the automatic kV selection is on, the filt/spot key must be pressed before the filter can be changed.*

10.4 SETTING THE OBLIQUE VIEW ANGLE

The angle to which the C-arm will rotate when an oblique view is chosen can be changed to any angle between 15 degree and 75 degrees.



Make sure that neither breast selection key is on and the C-arm is in the vertical (CC) position. Press this key to activate the secondary function mode. The indicator light will come on.



Press this key to select the oblique view. The angle to which the C-arm will rotate will appear on the angle/force display and start to flash.



Press either of these keys to change the oblique angle. The new angle will appear on the display.



Press this key to store the new oblique angle in the memory. You can also wait until the number on the display stops flashing.

10.5 MANUAL EXPOSURE PROCEDURE



Press this key to switch the automatic exposure control (AEC) off, the indicator light will go out and the density and sensor displays will clear.

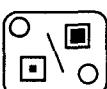


Press this key to lower the cassette table. The indicator light will flash as the cassette table moves. When the cassette table stops moving the light will stay on.

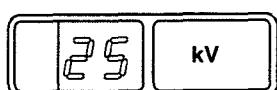
Load the cassette.



Press this key to move the cassette table back to the ready position. The indicator will flash until the cassette table stops moving.



Select the required focal spot. The appropriate indicator light will come on. Remember that if you change from the large focal spot to the small spot the key must be pressed and held down.

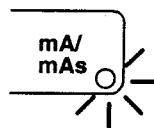


Select the required kV value according to the build of the patient.

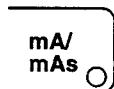
NOTE *You can set the unit so that it will automatically display a recommended kV value after the breast has been compressed. See section "10.1 AUTOMATIC kV SELECTION" on page 36.*



Now select **EITHER** an mAs value **OR** an mA value and exposure time by pressing and holding down this key until the indicator light comes on or goes out, depending on the original setting.



When the indicator light is **ON** an **mA** value can be selected, note that the exposure time is selected automatically.

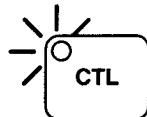


When the indicator light is **OFF** an **mA** value and an **exposure time** can be selected.

In both cases the display value will start to flash. Select the correct mAs or mA value and exposure time according to the build of the patient.

You can now compress the breast, and take an exposure in the same way as described in section 7 "CONTACT VIEW PROCEDURE" on page 23 and section 8 "BREAST COMPRESSION PROCEDURES AND TAKING AN EXPOSURE" on page 28.

10.6 SETTING THE CORRECT TIME AND DATE



Select the secondary function mode by pressing the CTL-key. The indicator light will come on.



Press the CLOCK-key once (or repeatedly) to step to the parameter(s) to be adjusted, the sequence is: minutes - hours - day - month - years - century.



The parameter to be altered with the PLUS/MINUS-key is blinking.

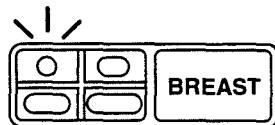


Press the CTL-key to exit at any time. Upon exit the (non visible) seconds counter is zeroed. The clock is set at the factory to local time and should be set to show correct time/date before using the unit.

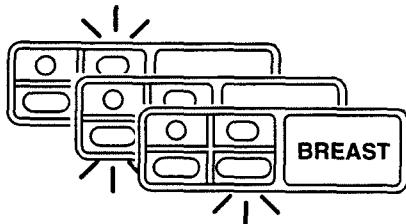
10.7 QUICK EXPOSURE SETTINGS - SELECTION

For added convenience the unit incorporates a memory in which four commonly used sets of exposure settings are stored. By pressing a single key you can quickly and easily select the exposure settings you require.

The exposure settings can be changed to suit your particular requirements. See section 10.8 "QUICK EXPOSURE SETTINGS - PROGRAMMING" on page 41.



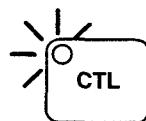
Press this key once and the exposure settings in the first memory location will be recalled. The top left indicator light will come on and all the exposure values that were chosen will appear on their respective displays.



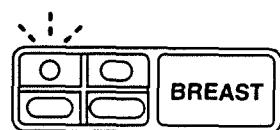
By pressing this key a second, third, and fourth time you can recall the other three sets of exposure settings. The indicator lights will come on indicating which memory location has been chosen. Pressing the key a fifth time will exit the memory and the indicator lights will go out.

10.8 QUICK EXPOSURE SETTINGS - PROGRAMMING

Select the exposure settings you wish to store in the memory.



Select the secondary function mode. The indicator light will come on.



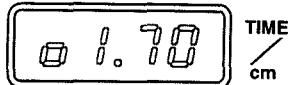
Select the memory location in which you wish to store the new exposure settings. The corresponding indicator light and secondary function key indicator light will start to flash.



Press this key to store the new exposure settings into the memory. The indicator light will stop flashing and go out.

10.9 SETTING THE MAGNIFICATION FACTOR

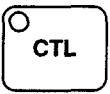
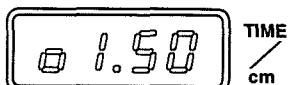
Press this key to select the secondary function mode. The indicator light will come on.



Press this key if you are not already in the magnification mode. The magnification will appear on the display and start to flash.



Press either of these keys to change the magnification. The magnification is adjustable from 1.3 to 1.8 in steps of 0.1.



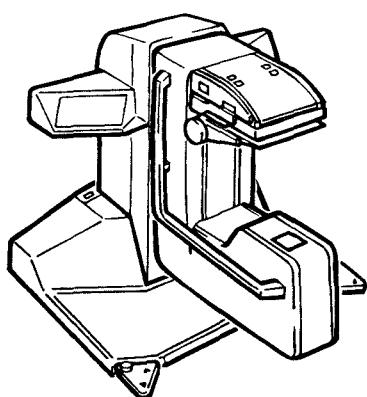
Press this key to accept the new magnification mode and exit the programming mode. If you are already in the magnification mode the C-arm will move to the new magnification position and the magnification will appear on the display. If you are not in the magnification mode the new magnification will be stored in the memory.

10.10 POSTERIOR-ANTERIOR VIEWING ANGLE

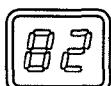
or



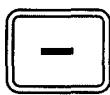
Select the breast to be examined by pressing the appropriate key. The corresponding indicator light will come on



Press and hold this key for two seconds and the C-arm will rotate to the PA position.



ANGLE
FORCE



Press this key if you wish to alter the posterior-anterior viewing angle slightly. The C-arm can be moved up to approximately 15° in the counterclockwise direction. The new angle will appear on the display.

Note that the physical limits of the unit will not allow you to adjust the position of the PA position in the clockwise direction.

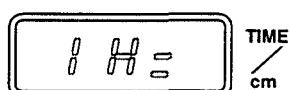
10.11 SETTING THE SPEED OF MOVEMENT OF THE COMPRESSION PADDLE

During compression the upper paddle moves downwards at two different speeds:

- the speed of initial descent, no compression
- the rate at which the speed decreases during the compression stage.

These speeds can be adjusted.

Press this key to enter the secondary function mode.

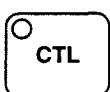


Press and hold this key to select the initial speed of descent range. The current speed number will appear on the main display and start to flash.

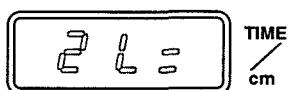
Select the speed you require for the initial descent. The number 1 is the slowest speed and the number 6 is the fastest speed.

NOTE *The setting 0 (zero) should and can be used only if the compression force measurement is inoperative. When the speed 0 is selected the force measurement is totally ignored. Compression starts at a moderate speed and continues only at crawling speed, after the compression movement is shortly interrupted by releasing the control switch.*

Press this key again to accept the new initial descent speed. The indicator light will go out.

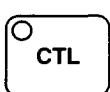


Re-enter the secondary function mode, the indicator light will come on.



Press and hold this key to select the rate at which the speed will decrease during the actual compression stage. The current speed decrease number will appear on the display and start to flash.

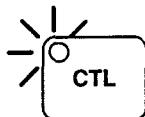
Press either of these keys to select the speed decrease number you require. The number 1 is the slowest speed decrease and the number 6 is the fastest speed decrease.



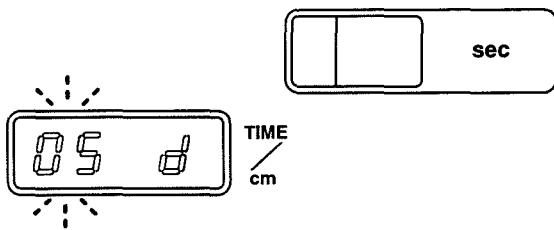
Press this key again to accept the new speed decrease number and exit the secondary function mode. The indicator light will go out.

10.12 ADJUSTING THE DURATION OF THE PARAMETER TIME-OUT

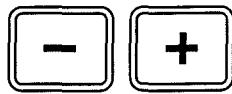
When a parameter key is pressed the value on the display will flash for a certain period of time during which the value can be changed. The length of time that the value flashes (time-out) can be adjusted.



Press this key to select the secondary function mode. The indicator light will come on.



Press this key and the current length of time (in seconds) that the parameter value flashes will appear on the main display.



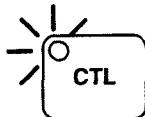
Press either of these keys to adjust the duration of the time-out. The minus (-) key will decrease the duration (minimum 3 seconds) and the plus (+) key will increase the duration (maximum 12 seconds).



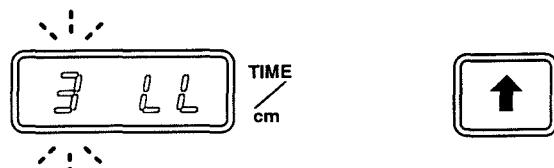
Press this key to accept the new time-out duration and exit the secondary function mode. The indicator light will go out.

10.13 ADJUSTING THE INITIAL SPEED AT WHICH THE C-ARM MOVES UP AND DOWN

When adjusting the height of the C-arm it will move slowly at first and then accelerate. The speed at which the C-arm initially moves can be adjusted.



Press this key to select the secondary function mode. The indicator light will come on.



Press this key and the initial speed at which the C-arm moves up and down will appear on the main display.



Press either of these keys to adjust the speed of movement. The minus (-) key will decrease the speed (minimum 1) and the plus (+) key will increase the speed (maximum 6).

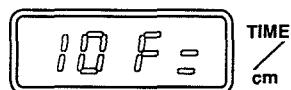


Press this key to accept the new speed and exit the secondary function mode. The indicator light will go out.

10.14 SETTING THE STOP LIMIT OF THE COMPRESSION FORCE



Press this key to enter the secondary function mode. The indicator light will come on.



Press and hold this key to select the compressive force setting mode. The current force, in kilograms, will appear on the display and start to flash.



Press either of these keys to select the stop limit of compression force. The minimum limit is 1kg (2.2 lb) and the maximum limit is 20 kg (44 lb). When you reach the preset limit during compression you will hear a signal tone and compression will stop. Compression can be continued after this but only at a very slow speed.



Press this key again to accept the new stop limit for the compressive force and exit the secondary function mode. The indicator light will go out.

10.15 SWITCHING THE FILM MARKING SYSTEM ON AND OFF

The unit incorporates a film marking system that automatically prints during the exposure the view information (the breast selected and the viewing angle used) at the top of the film. This film marking system can be switched off so that the information will not appear on the film. The film marking texts are described in section 7.2 "BREAST AND VIEW SELECTION" on page 24.



Press this key to select the secondary functions. The indicator light will come on.



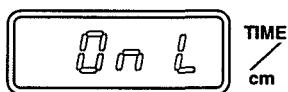
Press and hold down this key until one of two messages appears on the main display. The message will depend on whether the film marking system was previously switched on or off.



This message indicates that the film marking system is switched off and no view information will be printed on the film.



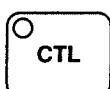
If you wish to switch the film marking system on press this key.



This message indicates that the film marking system is switched on and view information will be printed on the film.

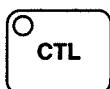


If you wish to switch the film marking system off press this key.



Press this key to accept the new or existing selection.

10.16 ADJUSTING THE TONE OF THE EXPOSURE WARNING SIGNAL



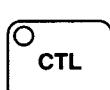
Press this key to select the secondary functions. The indicator light will come on.



Press and hold down this key until you hear the exposure warning signal.



Press either of these keys to change the tone of the warning signal. The plus sign (+) will increase the tone and the minus sign (-) will decrease the tone.

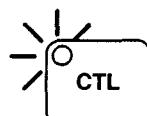


Press this key to accept the new or existing tone.

10.17 ADVANCED AEC CONTRAST/DOSE ADJUSTMENT

In the **advanced AEC mode** the kV value is automatically adjusted to give the optimum exposure time. If the kV is increased the mAs will decrease resulting in a lower radiation dosage and lower film contrast. If the kV is decreased the mAs will increase resulting in a higher radiation dosage and higher film contrast.

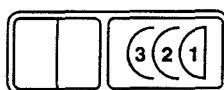
If, when you are using this mode, you find that you wish to change the film contrast or radiation dosage it can be done as follows.



Press this key to enter the secondary function mode. The indicator light will come on.



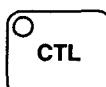
TIME
cm



Press and hold this key until the current contrast/dose setting appears on the main display and starts to flash.



Press either of these keys to change the setting of the contrast/dose. The plus (+) key will increase the film contrast, and the radiation dose (the mAs will increase and the kV will decrease) and the minus (-) key will decrease the film contrast and the radiation dose (the mAs will decrease the kV will increase). The highest setting is +3 and the lowest setting is -3.



Press this key to store the new contrast/dose setting into the memory. The indicator light will stop flashing and go out.

11 TRANSPORTING THE UNIT**CAUTION**

The unit must only be transported by qualified service personnel.

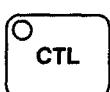
11.1 PREPARING THE UNIT FOR TRANSPORTATION

Remove the film cassette and lower paddle, slide the foot controls in, and disconnect the remote exposure switch.

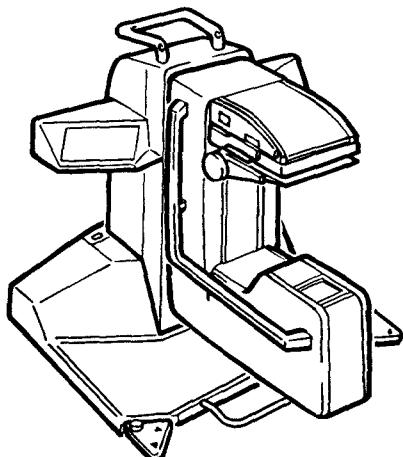
NOTE *If you are going to repack the unit, the C-arm locking knob must be inserted to the unit's base before driving the unit to the transportation position.*

**CAUTION**

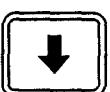
Note, that the knob must be rotated as down as it goes so that the locking stud just touches the knob when driving the C-arm down.



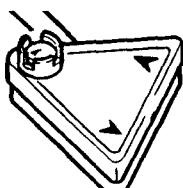
Press this key to enter the secondary function mode. The indicator light will come on.



Press and hold this key (about four seconds) until the C-arm starts to rotate. The C-arm will automatically rotate in a clockwise direction from the operating position to the transportation position. At the same time the telescopic column will automatically lower and then rise slightly. When the C-arm reaches the transportation position it will stop moving.

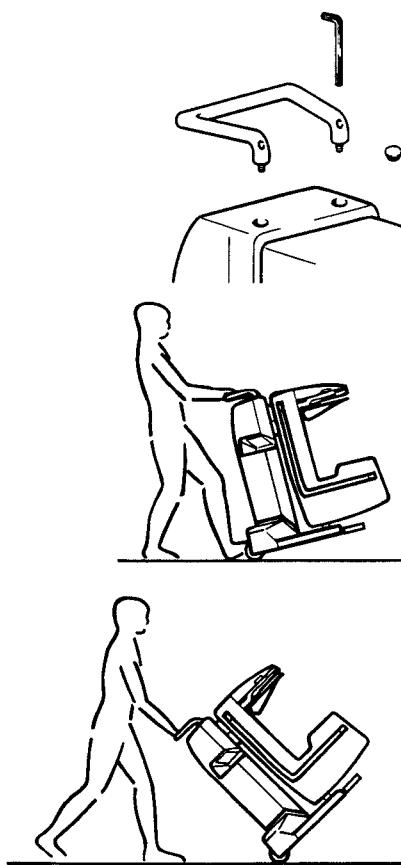


Press this key to drive the C-arm to the lowest position.



NOTE *Press the foot control to stop the C-arm from moving.*

To start the C-arm moving again repeat the keying sequence described above.



Remove the two cover plugs from the hood, insert the transportation handle into the two holes and tighten the holding screws.

The unit is now ready for transportation. Support the cast base (not the metal cover) with your foot and pull the back the unit back, using the transportation handle, until it is on the transportation wheels. NEVER TRY TO MOVE THE UNIT USING THE HANDRAILS OR CONSOLE ARMS.

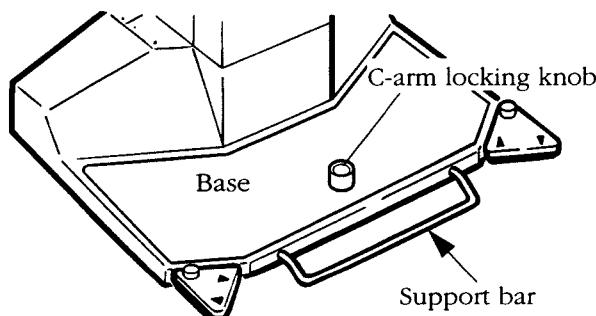
The unit can now be moved. Transport it with care. Do not bump the unit down steps or allow the tube head assembly to hit anything. Never try to move the unit with the C-arm in any other position than the transportation position.

11.2 SETTING UP THE X-RAY AFTER TRANSPORTATION

When you reach the place where the unit is to be used support the base of the unit with your foot and lower the front of the unit gently on to the floor. Do not allow the unit to drop heavily on to the floor or you may damage the tube head assembly.

WARNING

IF THE UNIT IS NOT BOLTED TO THE FLOOR THE SUPPORT BAR MUST BE ATTACHED TO THE FRONT OF THE BASE.

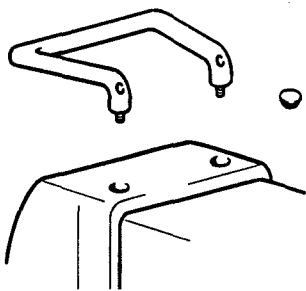


Adjust the support feet, which are under the base plate, until the unit is stable.

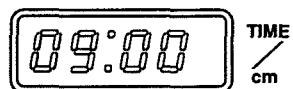
Make sure that the C-arm has enough room to rotate without hindrance.

Observe any local or national radiation shielding requirements.

TRANSPORTING THE UNIT



Remove the transportation handle by unscrewing the two holding screws. Replace the two cover plugs.

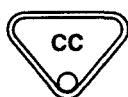


Connect the unit to the power supply and switch the unit on with the on/off switch which is located on the base behind the fixed column.

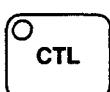
The unit will carry out a self-test. When the unit is ready to use the time will appear on the display.



Press this key to enter the secondary function mode. The indicator light will come on.



Press and hold this key (about four seconds) until the C-arm starts to move. The C-arm will rotate in a counterclockwise direction from the transportation to the operating position. At the same time the column will rise to a preset height, about three quarters of the maximum height. When the C-arm gets to the correct position it will stop moving.



Press this key if you wish to stop the C-arm from moving.



Press this key to start the C-arm rotating again.

If the C-arm locking knob was inserted before transportation, remove it by turning it counterclockwise. Replace the cover plug to the hole.

Connect the remote exposure switch to the unit. Make sure that the position from which exposures are to be taken is correctly shielded. The unit is now ready to use.

12 HELP MESSAGES

HE	HELP MESSAGE EXPLANATIONS
HE 1	Magnification is not allowed with Bucky connected. Remove the bucky
HE 2	Bucky is not correctly positioned or properly inserted into the unit. Check that its firmly inserted.
HE 4	The cassette is not properly positioned into the holder. Push the cassette towards the labeling head.
HE 5	The cassette was not removed after the previous exposure (double exposure prevention).
HE 6	The cassette table is in an undefined position. Either set it to Large or Small position.
HE 7	A large cassette with a small lower paddle is not allowed because the lower compression paddle would collide with the cassette. Either change to a small cassette or a large lower compression paddle (for contact views the lower paddle can be removed completely).
HE 8	A small cassette with a large lower paddle is not allowed because the film labeling head would collide with the compression paddle. Either change to a large cassette or a small lower compression paddle (for contact views the lower paddle can be removed completely).
HE 9	No projection angle is selected. Use the LM, MLO and CC-keys for projection selection.
HE 10	The lower compression paddle has risen too far upwards. Check what is obstructing the paddle upwards and remove the reason.
HE 11	The Up/Down movement is not allowed during the compression of the breast. Drive paddle up first.
HE 12	Select the breast first (press the SIN or DEX-key)
HE 13	The Aluminum filter (filter no 2) is not allowed with kV-settings lower than 30 kV. Increase the kV-setting first if you wish to use the Aluminum filter.
HE 14	The kV-setting cannot be changed before you either reduce the mA-setting or SEC-setting.
HE 15	A higher mA-setting is not allowed with the current kV- and/or SEC-setting. Decrease either the kV-setting or the SEC-setting.
HE 16	A longer exposure time is not allowed with current kV- and/or mA-setting. Decrease the kV- and/or mA
HE 17	The mA- or the SEC-setting cannot be further increased since you have reached the maximum allowed mAs-value of 300 mAs. (Regional limit)
HE 18	A higher mAs-value is not allowed with the current kV-setting. Decrease the kV-setting first.
HE 19	The use of AEC-sensor no. 3 is not allowed in the spot mode. The sensor is outside of the beam.
HE 20	This key functions only when AEC-mode is on. Select the AEC-mode first with the AEC-key.
HE 21	This key functions only in the manual exposure mode. Select manual mode first by with the AEC-key.
HE 22	This function can be selected only in the manual mA-mode.

HE	HELP MESSAGE EXPLANATIONS
HE 23	This key has no function in combination with the CTL-key. Press the CTL-key to turn it off.
HE 24	The + and - keys (plus and minus) have no function before you select a value to be altered.
HE 25	Press first the CTL-key to clear the error message from the display.
HE 26	This key has no function in the STEREOTACTIC-mode (ex. SIN, ML, LOAD etc.).
HE 27	The exposure switch must be first released.
HE 28	Press and hold down any of the foot controls, otherwise the C-ARM will not rotate.
HE 29	Press first the LOAD-key. You cannot proceed because the cassette table is in the LOAD-position.
HE 30	Remove needle first. The UP/Down movement or the change of projection is not allowed in the STEREO-mode, if the needle is in the holder. OR The Cytoguide operator's console is switched off.
HE 31	Use the REL-key to drive the STEREO- device.
HE 32	Press the CTL-key to exit the Breast-macro programming mode
HE 33	The unit cannot be driven to the LOAD or MAG position when the stereotactic device is used.
HE 34	The C-arm will not rotate unless the foot control is pressed and held down. The patient can remain in the exposure position.
HE 35	You can not select the Automatic paddle release.
HE 36	You have to release the upper compression paddle before selecting the exposure view. Press and hold down the REL-key until the upper compression paddle has reached its highest position
HE 37	The bucky grid is not connected.
HE 39	The AAEC mode is not allowed with current kV-setting. Increase the kV-setting first if you wish to use AAEC. OR A lower kV-setting is not allowed with the AAEC.

13 ERRORS AND ERROR MESSAGES

If the unit malfunctions or you make a mistake when using the equipment an error message will appear on the display.



Before corrective action can be taken press this key to clear the error message from the display.

The error messages are divided into three categories.

These error will appear when you take an exposure and can be easily corrected.

ERROR CODE	REASON	CORRECTIVE ACTION
<i>Er 00</i>	You removed your finger from the remote exposure button before the exposure was complete.	Clear the error message. Remove the partially exposed film from the cassette and process the film to see if it has been correctly exposed. If not place a fresh film in the cassette and take another exposure. Remember to hold the exposure button down for the duration of the exposure.
<i>Er 03</i>	The AEC sensor that has been selected is not detecting any, or enough, radiation.	Clear the error message and check that nothing foreign is obstructing the radiation beam. If not, either increase the kV value or select a different AEC sensor or use the unit in the manual mode.
<i>Er 29</i>	One of the keys on the control panel was being held down as the unit was carrying out its self test during start up.	Remove the obstruction. Clear the error code and the unit can be used. If the error code reappears contact your sales representative for help.
<i>Er 39</i>	One of the cassette table keys was being held down as the unit was carrying out its self test during start up.	Remove the obstruction. Clear the error code and the unit can be used. If the error code reappears contact your sales representative for help.
<i>Er 40</i>	Lower compression paddle is not firmly inserted or is lifted up by some obstructing it.	Push the paddle firmly to its position or remove the obstruction. Clear the error code and the unit can be used. If the error code reappears contact your sales representative for help.
<i>Er 57</i>	The remote exposure switch was being held down as the unit was carrying out its self test during start up.	Remove the obstruction. Clear the error code and the unit can be used. If the error code reappears contact your sales representative for help.
<i>Er 58</i>	One of the foot controls was being held down as the unit was carrying out its self test during start up.	Remove the obstruction. Clear the error code and the unit can be used. If the error code reappears contact your sales representative for help.

ERROR CODE	REASON	CORRECTIVE ACTION
Er 86	The unit detected a brief drop in the mains voltage.	Clear the error message. You can now continue to use the unit.

These error messages indicate that the unit will not operate in the AEC mode. You can continue to use the unit in the manual mode.

ERROR CODE	REASON	CORRECTIVE ACTION
Er 14	The AEC sensor is not calibrated.	Clear the error message and continue to use the unit in the manual mode. Contact your sales representative for help.
Er 15	The AEC sensor is faulty.	Clear the error message and continue to use the unit in the manual mode. Contact your sales representative for help.

Other error codes

ERROR CODE	CORRECTIVE ACTION
All other error codes	If any other error messages appear first clear the error message and then see if the unit will work correctly. If it does not, switch the unit off from the main power supply, wait a few seconds and then switch the unit on again. If the unit still does not work correctly contact your local sales representative for help.

14 MAINTENANCE

The following maintenance work should be carried out.

14.1 DAILY CHECK

A test exposure, using a tissue equivalent test phantom should be taken at least once a day to ensure that the mAs and AEC exposure and density values remain consistent.

Check the condition of the film processing unit. Make sure that the chemicals used are fresh and that the processing times and temperatures are constant.

Carry out a sensitometry test.

All exposed surfaces should be periodically wiped with a soft damp cloth.

The upper and lower compression paddles can be cleaned using a mild soap solution and water.

14.2 SERVICING

To keep the unit in compliance with § 1020.30 - 31 the following things must be checked once a year.

Leakage radiation

HVL-measurement

Linearity and reproducibility (also AEC)

kV

mA

mAs

Exposure time

Automatic exposure control limits

Illuminance of light localizers

Alignment of visually defined x-ray field and contrast of the light field

X-ray field size

Transmission limit

15 TECHNICAL SPECIFICATIONS

MANUFACTURED BY:

Planmed Oy
Asentajankatu 6
00810 Helsinki
Finland

MODEL

Planmed Sophie
IEC safety class: I
IEC degree of protection: B
IEC enclosure class: IP20

X-RAY TUBE ASSEMBLY

X-ray tube	Toshiba E7236 or Toshiba E7272 (Refer to tube head label)
Anode type	rotating anode
Anode thermal capacity	300 000 HU
Target material	molybdenum
Tube port material	beryllium
Focal spot size	0.1/0.3mm
Filtration	30µm Mo, 0.5mm Al or 25µm Rh

GENERATOR ASSEMBLY

Generator	constant potential, microprocessor controlled, high frequency.
Anode voltage	20 - 35kV ±2kV
Anode current - 0.3mm	30 - 110mA (30 - 120 mA @ 60Hz) ±5mA
Anode current - 0.1mm	E7236: 10 - 26mA (10 /28 mA @ 60Hz) ±1mA E7272: 10 - 22mA (10 /22 mA @ 60Hz) ±1mA
mAs range - 0.3mm	10 - 500mAs (optional 600mAs) ±4mAs or ±10% whichever is larger
mAs range - 0.1mm	10 - 200 mAs
Exposure time - 0.3mm	0.1 - 5 seconds (optional 6 seconds) ±5%
Exposure time - 0.1mm	0.1 - 9.9 seconds ±5%
Cooling	automatically controlled
Line voltage	208 - 240VAC, 50 or 60Hz - single phase
Line voltage compensation	automatic ±10%
Line voltage regulation	10%
Fuses	2 x 15AT / 250V
Power consumption	100VA, 4000VA max. 5 seconds
Mode of operation	intermittent
Maximum apparent resistance of supply mains	1ohm
Maximum continuous heat dissipation	250W

Complies with IEC 601-1 safety and IEC 601-2-7 radiation performance regulations

C-ARM

Rotation	motorized, range -135°... +180°
Vertical movement	motorized range 795mm... 1350mm (31.3in... 53.1in)
SID	650mm
Compression	motorized
Cassette	18 x 24cm and 24 x 30cm
Magnification	motorized, range 1.3...1.8

AUTOMATIC EXPOSURE CONTROL

Sensors	three solid-state sensors
Density adjustment	15 density steps (13% change per step)

MECHANICAL DATA

Dimensions (H x D x W)	930 x 890 x 800mm minimum (36.6 x 35.0 x 31.5in)
Weight	160kg (352lbs)
Colour	RAL 9002

The technical specifications are subject to change without notice

16 USER'S STATEMENT FOR THE PLANMED SOPHIE

Radiation Leakage Technique Factors

The maximum-rated peak tube potential is 35kVp and the maximum rated continuous tube current is 3.5mA for the maximum-rated peak tube voltage.

Minimum filtration

The Beam-limiting device contains three different filtrations 30 μ m molybdenum, 25 μ m rhodium and 0.50mm aluminum. The measured half-value layers are 0.343mmAl, 0.373mmAl and 0.377mmAl at 30kVp. These measured values correspond to aluminum equivalents of 0.55 - 0.65mmAl.

Rate line voltage

208 - 240VAC \pm 10%. Line voltage regulation 10%.

Maximum line current

Maximum 22 Amps.

The technique factors that constitute the maximum line current condition.

27kV / 110mA

Generator rating and duty cycle.

3kW

approximately 1:25 for the large focal spot
and 1:5 for the small focal spot

The duty cycle is calculated using the following formula:

Wait period = $T_w = kV * mA * \text{exp. time} / 120W$

Duty Cycle = $1 / (1 + kV * mA / 500W)$

Maximum Deviation of Peak Tube Potential from Indicated Value:

\pm 2kV

Maximum Deviation of Tube Current from Indicated value:

\pm 5mA, large focus

\pm 1mA, small focus

Maximum Deviation of Exposure Time Tube current Product from Indicated Value:

\pm 4mAs or \pm 10%, whichever is larger

Maximum deviation of exposure time from indicated value

\pm 5%

The measurement Criteria that Define the Technique Factors:

Exposure time:

The beginning and end points of the exposure time are defined at 70% of the peak radiation wave form measured with a calibrated x-ray monitor.

Peak tube potential:

Is defined as the measured high voltage mean value measured with a calibrated noninvasive kVp meter.

Tube current:

Is defined using the resistance and voltage over the feedback resistor measured with a calibrated multimeter. The mA value is then the voltage divided by the resistance.

mAs product:

Is defined as the product of the exposure time and the tube current measurements.

The nominal X-ray voltage together with the highest X-ray tube current obtainable from the high voltage generator when operated at its nominal X-ray tube voltage

35kV 80mA / 60Hz - large focus

35kV 70mA / 50Hz - large focus

35kV 16mA / 60Hz - small focus

35kV 14mA / 50Hz - small focus

The highest X-ray tube current together with the highest X-ray tube voltage obtainable from the high-voltage generator when operated at its highest x-ray tube current

120mA 24kV / 60Hz - large focus

10mA 24kV / 50Hz - large focus

E7236: 28mA 20kV / 60Hz - small focus

26mA 20kV / 50Hz - small focus

E7272: 22mA 26kV / 60Hz - small focus

22mA 24kV / 50Hz - small focus

The X-ray tube voltage and X-ray tube current which result in the highest electric output power

27kV 110mA / 60Hz - large focus

34kV 80mA / 50Hz - large focus

24kV 24mA / 60Hz - small focus

24kV 22mA / 50Hz - small focus

24kV 22mA / 60Hz - small focus

24kV 22mA / 50Hz - small focus

The nominal electric power for a load time of 0.1s and at the nominal X-ray tube voltage

35kV 80mA / 60Hz - 2800W large focus

35kV 70mA / 50Hz - 2450W large focus

35kV 16mA / 60Hz - 560W small focus

35kV 14mA / 50Hz - 490W small focus

Reference current time product

Large focal spot: for all kV values 40mA 0.1s 4mAs

Small focal spot: for all kV values 10mA 0.1s 1mAs

The lowest current time product within the specified range of compliance

Large focal spot: 30mA 0.1s 3mAs

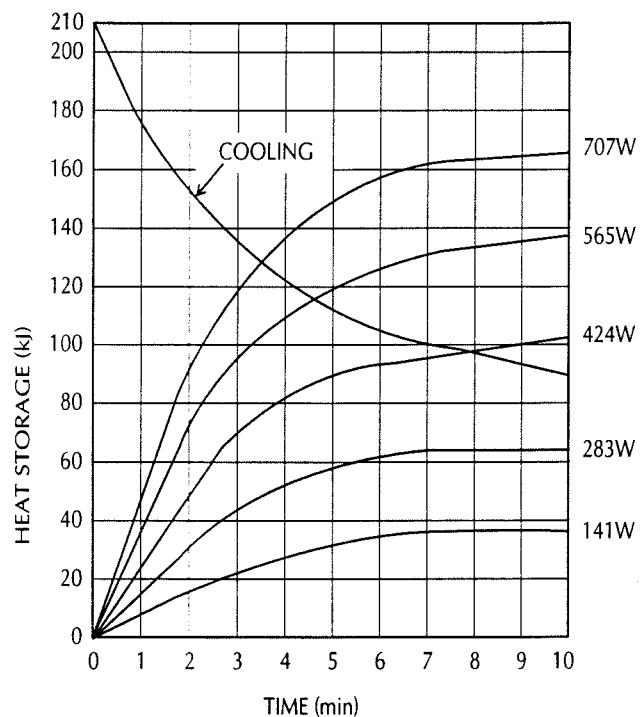
Small focal spot: 10mA 0.1s 1mAs

The nominal shortest irradiation time in the AEC mode

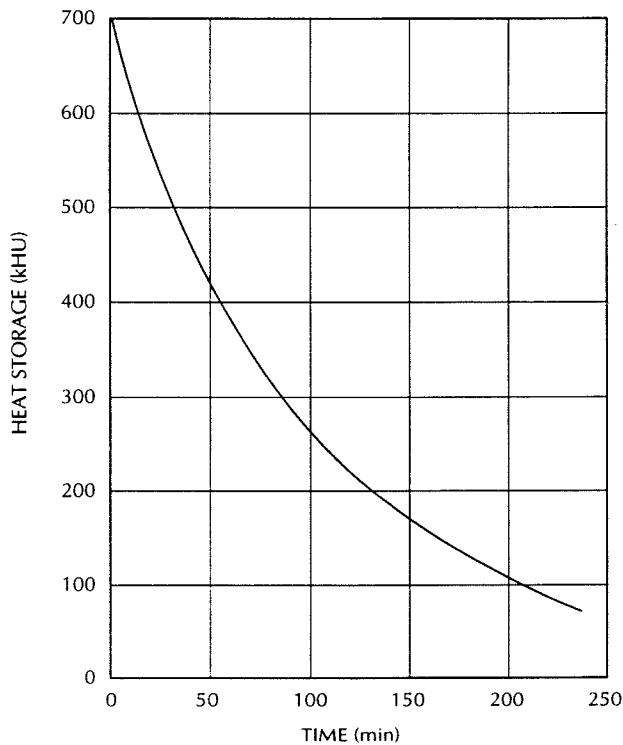
20ms

Cooling curves for E7236 and E7272

ANODE THERMAL CHARACTERISTICS



The heating curves show examples of average input power to the anode in operation.

PLANMED SOPHIE TUBE HOUSING
HEAT DISSIPATION CAPACITY

Toshiba E7236, E7272 tube ratings**Manual exposures**

With manual exposures the tube kV, mA and exposure time can be selected by the user. We have limited the maximum values with software so, that for large focal spot there are two maximum mA-values for each kV, one for times up to 1 sec and other up to 5 sec. For small focal spot there are also two mA-values for each kV, one for times up to 5 sec and other up to 10 sec. These limit values we have defined separately for 50 Hz and 60 Hz. The minimum mA for small focal spot is 10 mA and can be increased in 2mA steps to the maximum. For large focal spot the minimum mA is 30 mA and can be increased in 10 mA steps to the maximum. The parameters are listed in Table 1, Manual mode ratings.

Automatic exposures

Automatic exposures are made with a radiation detector that stops the radiation when the required dose has been reached. In this mode the kV is selected by the operator and mA is chosen to be the maximum allowed mA for that kV (and Hz) from the tables above (mA values for under 1 sec for large focal spot and under 5 sec for small).

If the time is longer than 1 sec (5 sec) we are using a falling load technique. The exposure is started at the mA specified in the tables for short exposures (1 or 5 sec). The dose is checked at 0.45 sec (2.45 sec for small focus) and if it has reached half of the dose, the exposure can be continued at the same mA and will be terminated before tube overload (in less than 1 or 5 sec).

If the dose is detected to be less than half of the required, a longer exposure time than the one specified for the tube current can be expected. Therefore the tube current is reduced at this time (after 0.45 or 2.45 sec) to a lower mA that, when added to the tube load condition after 5 sec (10 sec for small focus) total exposure time. The start currents and the lower continuing currents are listed in Table 2, Automatic mode ratings.

Thermal ratings

There are two separate methods to protect the tube. One is measuring the tube head (the whole enclosure) temperature and if it exceeds 60 °C no further exposures are allowed until the temperature has fallen below 60 °C.

The other method keeps the average power input into the tube below 120W. The exposure parameters are limited by the above tables, but this feature forces waiting time between the exposures dependent on the exposure parameters. For example if an exposure of 24 kV, 100 mA, 1 sec is performed a wait period of 20 seconds is calculated and no further exposures are allowed until this time has elapsed.

Table 1: Maximum mA for Tube E7236 vs. different modes and line frequencies

kv	MANUAL EXPOSURE MODE								AUTOMATIC (AEC) EXPOSURE MODE											
	Large focus (0.3 mm)				Small focus (0.1 mm)				Large focus (0.3 mm)				Small focus (0.1 mm)							
	0 - 1 sec		1 - 5 sec		1 - 6 sec		0 - 5 sec		> 5 sec		0 - 1 sec		0.45 - 5 sec		0.45 - 6 sec		0 - 5 sec		2.45 - 10 sec	
Hz	50	60	50	60	50	60	50	60	50	60	50	60	50	60	50	60	50	60	50	60
20	100	100	100	100	90	90	26	28	20	20	100	100	100	100	89	94	26	28	18	20
21	100	100	100	100	100	100	24	26	18	20	100	100	100	100	94	94	24	26	18	18
22	110	110	100	110	100	100	24	26	18	18	110	110	98	110	98	110	24	26	16	18
23	110	110	100	110	100	100	22	24	18	18	110	110	98	110	98	110	22	24	16	18
24	110	120	100	100	90	90	22	24	16	18	110	120	98	108	93	103	22	24	16	17
25	100	110	90	100	90	90	20	22	16	16	100	110	95	97	90	92	20	22	14	15
26	100	110	90	90	90	90	20	22	16	16	100	110	91	98	89	96	20	22	14	15
27	100	110	80	90	80	80	18	20	14	16	100	110	87	87	83	83	18	20	14	14
28	90	100	80	90	80	80	18	20	14	14	90	100	85	88	79	82	18	20	12	14
29	90	100	80	80	80	80	18	20	14	14	90	100	82	88	78	84	18	20	12	13
30	90	90	80	80	70	70	16	18	12	14	90	90	80	77	75	72	16	18	13	13
31	80	90	70	80	70	70	16	18	12	14	80	90	77	78	73	72	16	18	10	12
32	80	90	70	80	70	70	16	18	12	12	80	90	75	78	69	72	16	18	10	11
33	80	90	70	70	60	60	16	16	12	12	80	90	72	78	67	73	16	16	10	11
34	80	80	70	70	60	60	14	16	12	12	80	80	70	68	65	65	14	16	11	10
35	70	80	60	70	60	60	14	16	10	12	70	80	67	68	64	65	14	16	11	10

Table 2: Maximum mA for Tube E7272 vs. different modes and line frequencies

kV	MANUAL EXPOSURE MODE										AUTOMATIC (AEC) EXPOSURE MODE									
	Large focus (0.3 mm)					Small focus (0.1 mm)					Large focus (0.3 mm)					Small focus (0.1 mm)				
	0 - 1 sec		1 - 5 sec		1 - 6 sec	0 - 5 sec		> 5 sec	0 - 1 sec		0.45 - 5 sec		0.45 - 6 sec		0 - 5 sec		2.45 - 10 sec			
kV	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz
20	70	70	70	70	80	80	20	20	20	20	70	70	70	70	80	85	20	20	18	20
21	80	80	80	80	90	90	20	20	18	20	80	80	80	80	90	95	20	20	18	18
22	90	90	90	90	100	100	22	22	18	18	90	90	90	90	100	105	22	22	16	18
23	100	100	100	100	100	100	22	22	18	18	100	100	98	100	98	108	22	22	16	18
24	110	110	100	100	90	90	22	22	16	18	110	110	98	108	93	103	22	22	16	17
25	100	110	90	100	90	90	20	22	16	16	100	110	95	97	90	92	20	22	14	15
26	100	110	90	90	90	90	20	22	16	16	100	110	91	98	89	96	20	22	14	15
27	100	110	80	90	80	80	18	20	14	16	100	110	87	87	83	83	18	20	14	14
28	90	100	80	90	80	80	18	20	14	14	90	100	85	88	79	82	18	20	12	14
29	90	100	80	80	80	80	18	20	14	14	90	100	82	88	78	84	18	20	12	13
30	90	90	80	80	70	70	16	18	12	14	90	90	80	77	79	72	16	18	13	13
31	80	90	70	80	70	70	16	18	12	14	80	90	77	78	73	72	16	18	10	12
32	80	90	70	80	70	70	16	18	12	12	80	90	75	78	69	72	16	18	10	11
33	80	90	70	70	60	60	16	16	12	12	80	90	72	78	67	73	16	16	10	11
34	80	80	70	70	60	60	14	16	12	12	80	80	70	68	65	65	14	16	11	10
35	70	80	60	70	60	60	14	16	10	12	70	80	67	68	64	65	14	16	11	10

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